# TELEPHONE ENGINEER

Volume XVII CHICAGO, APRIL 1917 No. 4

## State Governors Praise Automatic

*A few turns of the dial—10 seconds the time required for Governor Goodrich of Indiana to get the ear of Governor [illegible] via Automatic Telephone*

In the [illegible] preparedness and readjustment [illegible] are preparing their forces to secure and [illegible] Automatic Telephone is coming into the focus of [illegible]

Only a [illegible] after the new Automatic Tele[illegible] apolis Telephone Company was cut in service, Governor [illegible] capitol at Indianapolis a long distance call [illegible] the state capitol at Columbus, Ohio.

"I hear you very distinctly," said Governor [illegible] 1917 equipment in Indianapolis.

"Yes, and I hear you all right over the Automatic," [illegible] who is using the 1904 type of Automatic [illegible] splendid service [illegible]

All [illegible] been taken by stock [illegible] Telephone Company since [illegible] subscribers have been [illegible] from [illegible] people have shown [illegible] appreciation of Automatic service by [illegible] monthly increase in [illegible]

[illegible] judging from the experience of Cincinnati, Toledo, Dayton, Springfield, O., the Indianapolis Automatic [illegible] is going to be a satisfactory [illegible] 10—this [illegible]

[illegible] using only the Automatic Telephone [illegible] and [illegible] pays over $50 compares [illegible] furnishes superior service to customers.

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CHICAGO

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VOL. XVII CHICAGO, APRIL, 1917 NO. 4

## An Injection of Egotism

LACK of egotism is a queer charge to bring against telephone men. Maybe that is not the right word. But when we see Independent operators giving good service at a loss, and too timid to raise their rates, we wonder if they appreciate the value of the thing they represent and the importance of the work they are doing.

In that bright little Indiana association organ known as "Toll Line Flashes" is related the story of a farmer who wanted a rebate. Let the narrator retell it here:

> A few days ago a subscriber came to town in his automobile. He brought his telephone with him for repairs. The receiver hook seat had worked loose, leaving the battery in the circuit when the receiver was on the hook. He had not been entirely out of service but as he was coming to town he thought it no trouble to bring the "box" along. I repaired the instrument in a minute and he went away apparently rejoicing. I prided myself in having secured such a considerate subscriber; a man who would do a favor without a grouch after having had ten years of almost unbroken service. A few days later he brought the "box" back. A test revealed that the receiver conductor was loose on one side, apparently being pulled out when the receiver was dropped as far as the cord would let it go. A few minutes and the telephone was ready. He did not come on a special trip but brought the telephone when on a business trip. When he called for the "box" he assured me pointedly that I must rebate the two months' bill, the sum of $2.00, or he would not take the "box" along. Right there is where my early training served me well. My first impulse was to hit him in the middle of February (it happened on the 15th), but I smiled like a cigar store Indian and told him that I would try to worry along without him, although he had been a valuable ass-et to the telephone business. He went home without the telephone and actually existed a whole week without the infernal machine in his house. Your imagination as well as mine can picture that telephoneless subscriber as a thousand things came to mind which the telephone could settle. Just imagine the worst but keep in mind the image of a farmer whose communication with the world had been severed. Then he came back; not on general business, but on special business, and that was to pay the bill and get his telephone. He did not want to admit that he had been vanquished, but he made no charge for the trip. He even paid for the week he was without service.

The public must have the telephone at any price. It is so interwoven with the life of everyone from farm-hand to president that none can avoid its use. In a day when existence itself is keenly competitive, the man without a telephone is so handicapped that he must fail. If manufacturing and selling telephone service were a private industry, instead of a public utility, investors in telephone securities would be drawing the same kind of dividends that we now hear about in connection with certain autombolie concerns. In other words, instead of a difficult eight per cent a year, we should have become accustomed to returns of eight per cent a month. And the people would have paid it—make no mistake about that—just as they pay it to the automobile makers without a kick. They only think they must have automobiles; we know they must have telephones.

But telephone service is not a private industry. It is a public utility. The people have decreed that public utilities must be watched and checked, for the very reason that they are so necessary, and therefore so extremely profitable if unchecked.

The telephone operator is not placed upon his honor to be satisfied with a "reasonable"

return. He is compelled by force to keep within the limits of that condition. He is subjected to the constant suspicion that he is getting, or trying to get, more than he is entitled to, because that is just what the public is trying to do to him.

The situation does not demand that the telephone operator be a public benefactor, a philanthropist or even an altruist. The public tries to get all it can from him. He is assumed to be equally aggressive on his own side. The publicly appointed regulatory agent is the umpire—but an umpire who does not see the play, and must base his decision on testimony.

The operator who related his anecdote above experimented with one subscriber, and won out. No doubt a majority of operators would be equally bold in facing a single unit of the public. But the prospect of antagonizing the subscribers to one's system en masse and in toto is rather alarming. The cautious and conservative telephone manager visualizes a stack of service cancellations nearly as numerous as the listings in his directory. In modernized English, he gets cold feet.

It is a perfectly safe bet that the telephone operator who doubled his rates and lost all of his subscribers would get ninety per cent of them back inside of two weeks, and the rest in a month. Of course it cannot be done. Regulation forbids—and very few operators have any ambition to soak the people even if the coast was clear. They are not built that way.

But the thing that can be done, and must be done, is to put Independent telephony on a decently remunerative basis. If there is any doubt as to the specific figure (and there always is, even among experts) it is better to have rates too high than too low.

For you can always trust the public, and the commissions, and the politicians, to discover when rates are too high. They are far more keen to observe that condition than the operator is to discover that he is losing money at his own game. That is a rather critical commentary on the efficiency of the telephone man; but some of them need criticism.

We strongly advocate, during the next few years, a determined and aggressive effort to raise telephone rates. We believe the majority of operators should devote more attention to the collection of evidence supporting demands for higher rates. And we would be happy to see, especially among Independent operators, a more egotistical and even arrogant attitude toward the positively necessary work they are doing for the world.

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## Helping the Commissions

WHAT we said last month about "The Monopolistic Tendency of Commissions" brought some comment out of the Independent field. One operator in particular, whose managerial experience in several states gives exceptional weight to his opinions, is well worth quoting:

> My personal observation, over large Independent telephone business in three states, is that the commissions as a whole represent public sentiment. Public sentiment is against competition in telephone exchanges. Up to date this feeling has not, so far as my observation goes, extended to long distance service. * * * While there may be isolated instances in which their action is the result of close association with people who are trying to educate them to certain policies, it is manifest that all of the commissions are not under the influence of any particular corporations or individuals. * * * It is impossible for the Independent telephone business successfully to fight regulatory commissions in a matter of this kind, especially if the commissions are backed up by strong public sentiment. The profitable and successful thing for the Independent industry to do is to align itself with public sentiment, as represented by these commissions, and to make whatever changes are necessary to see to it that all things are carried out so that the industry, as a whole, does not suffer.

We like this view of the situation, because of its optimism and its basic belief in the ultimate dominance of public opinion. That the condition which occasioned our comment last month will eventually work itself out for the good of the industry and the public we cannot doubt. Nevertheless, it remains in evidence that the state commissions, or at least some of them, are at present subjected to an influence more Bell than Independent. We do not wish to be understood as intimating that this influence is malevolent or even undesirable. The proffer of aid to the commissions (who surely need it) is, indeed, a wise move and a good one. Our only criticism is that the Independents have neglected, in large measure, the opportunity to be of service.

The annual Bell report makes this comment on the relations of its companies to the regulatory bodies:

> The persistent policy of the company has been to co-operate with the various commissions, and so far as practicable to aid them in solving the problems that are presented, along the sound and just economic lines which must form the basis of any permanent success in the regulation of public utilities. To this end, it has been the constant purpose of the legal department to ascertain and establish the fundamental legal and economic propositions which must underlie sound regulation, and to present these principles clearly and forcibly to the various commissions.

Our correspondent insists, however, that the commissions are composed of people who are more or less hostile toward large corporations, and the larger the corporation the more hostile they are apt to be. He thinks the influence of the Bell companies upon the commissions is greatly overestimated, and that in many cases the effect is negative: The fact that the Bell companies want something is sufficient reason for opposing it.

If that condition is true, it is just as bad as too much Bell influence, and may be worse. We do not want the commissions to be antagonistic, or even indifferent, to legitimate business. There might be a brief and transient Independent triumph in a commission's anti-Bell attitude; but such a condition would never make for the stability of the industry.

Recognition of the state commissions as bona fide representatives of the people is the only policy that can establish a permanent success. It must always be remembered that the telephone company's public is all the public—not merely the list of subscribers in the directory. Every unit in the vast aggregation we know as the people of the United States—every individual, no matter how humble—has a voice in telephone regulation. Whether or not the individual is a telephone subscriber is of no significance.

If it be demonstrated that the public wants a single system in each community, all the logic and argument in the world will not convert it to dual service. And if the commissions, in advocating a single service, are really representing public opinion, there is no possibility of resisting the verdict.

The thing for the Independents to keep before them is that if there is to be but one service in a community, that service should be Independent. There is no need to admonish the Bell people along that line.

The thing we really want is an absolutely judicial attitude on the part of the commissions. This is only possible when all parties to a controversy work in harmony with the umpire, without regard for competitive differences. This means not that the salutary Bell influence should be withdrawn, but that it should be balanced by an equally helpful Independent influence.

## Forty-Two Per Cent Independent

THE Bell report for 1916 gives the total number of telephone stations "which constitute our system" as 9,847,192, of which 6,545,490 are Bell owned and operated and 3,301,702 are owned and operated by "local, co-operative and rural independent companies or associations having sublicense or connection contracts; the so-called connecting companies."

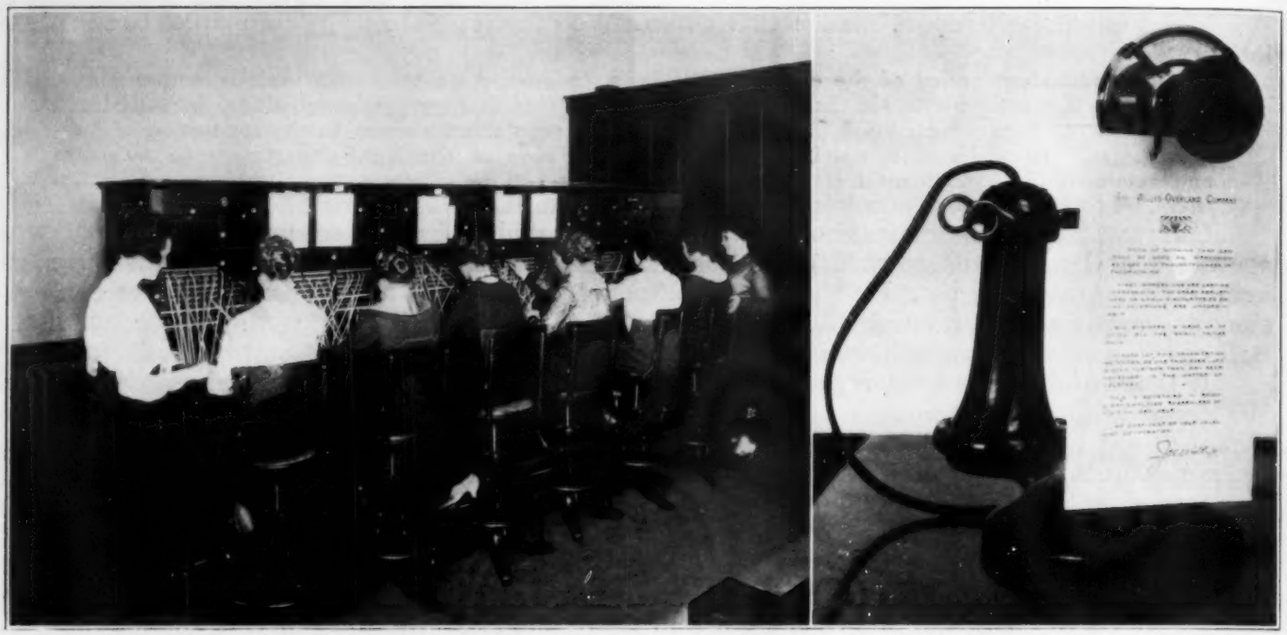
It also estimates that there are 11,300,000 telephone stations in the United States—a total of 4,754,510 Independent stations, of which 1,452,808 do not connect or have any relations with the Bell system.

And speaking of the rural companies, the farmers lines, it says "there are tens of thousands of such plants now in operation."

By its own figures the Bell report gives the Independents forty-two per cent of the telephones in the country. The numbers are quoted in an effort to disclaim monopoly, and are probably more nearly accurate than similar statistics from any other source. The Interstate Commerce Commission has not yet completed its figures on Class D companies, and the last government census, showing over thirty-two thousand companies, is five years old.

There is nothing in this situation discouraging to Independent telephony. If the Independent association could represent officially all these Independent stations, as the A. T. & T. Company represents the Bell stations, its power and influence would be great enough to give it first voice in the councils of both competition and regulation.

Universal association membership is as necessary to the Independent telephone companies as universal military training is to the citizens of the United States.



*Just above is a picture of the big private branch exchange switchboard at the Overland automobile plant in Toledo, and at the right is shown one of the company's telephones equipped with its "courtesy card." What John N. Willys, president of the Willys Overland Company, of Toledo, O., thinks of courtesy over a telephone is shown by the cards which he has had attached to each telephone instrument at his huge factory and administration building. The message on the card reads:—*

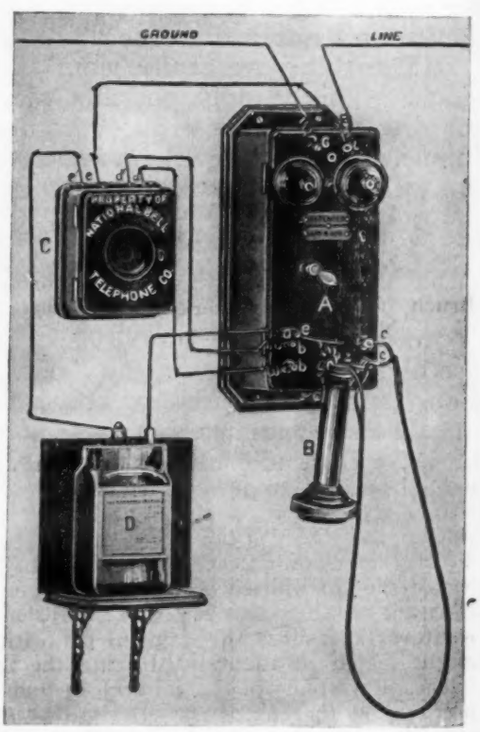
*"I know of nothing that can make so good an impression as care and thoughtfulness in telephoning.*
*"First impressions are lasting impressions. Too great abruptness or small discourtesies on the telephone are unforgivable.*
*"Big business is made up of doing all the small things well.*
*"Please let this organization be known as one that goes just a step farther than may seem necessary in the matter of courtesy.*
*"This is something in which every employe, regardless of position, can help.*
*"I am confident of your usual good co-operation."*
*"J. N. Willys."*

*There are more than 500 stations on the Willys-Overland private telephone exchange, and it is estimated that 10,000 calls are handled each eight-hour day.*

*This is an "O. Pip" (Tommy's" name for (observation post) of the British army in a Mesopotamian advance-trench, telephoning to the artillery. It is taken from one of the photographs by "Topical" which appear regularly in the Illustrated London News.*

*H. W. Kline, division plant superintendent of the Mountain States Telephone and Telegraph Company at Salt Lake City, Utah, sends us this photograph.*

*This pole has been in place approximately fifteen years and is set in solid salt. It is located in the salt beds which are west of the Great Salt Lake. The pole in question is located at Arinosa, a station on the Western Pacific Railway. You will note that the pole at a point about one foot to two feet above the ground line is badly shattered. On examination, the pole at this point will be found to be absolutely filled with finely divided salt. The action apparently has penetrated to a depth of something like one inch. We cannot offer an explanation of just what causes this action, but as it develops in a portion of the pole which is wet a part of the time and dry at other times, it may be related to the fact that water to a depth of about a foot sometimes covers the salt beds. This water comes and goes and seems to be under control of the winds. The water is blown in from the Great Salt Lake when the wind is in the proper direction, and will go away in a very short period on a change of wind.*




*This is a telephone set used in 1879. It was equipped with a gravity hook switch, operated by the weight of the receiver, and had a Blake transmitter. Its adoption followed the peace treaty between the Western Union Telegraph Company and the Bell Company.—From C. E. Scribner's article on "The Creation of the Telephone," Western Electric News.*

**STORIES IN PICTURES OF TELEPHONE PRACTICE AND PROGRESS IN ALL PARTS OF THE WORLD.**

# Independent Part in National Defense

*Association Vice President MacKinnon Pledges Co-Operation to Government*

F. B. MacKINNON, of Washington, D. C., has pledged to the government, through Secretary of War Baker, chairman of the Council of National Defense, the active co-operation of every Independent telephone company in the United States should the time come for the need of such co-operation in case of war or in any other emergency when the telephone lines of the country may be of service to the government.

*Vice President F. B. MacKinnon of the United States Independent Telephone Association.*

Should war be declared every telephone line of the country might at some time be needed by the government service. At all times government business takes precedence over private commercial business but in time of war this precedence is an absolute necessity. In fact were war to be declared the government would in a sense take control of all the telegraph and telephone lines of the country. Necessarily uniform rules for handling government business, regulation as to censorship of messages and arrangements for direct connections to all army headquarters would have to be established.

As a member of the Committee on Communication of the Advisory Commission to the Council for National Defence and appointed to represent not only the members of the United States Independent Telephone Association but every Independent telephone company, Mr. MacKinnon has pledged the active support of every Independent manager and employe.

This Committee on Communication consists of Theodore N. Vail, president of the American Telephone & Telegraph Company, chairman; Charles P. Bruch, vice president, Postal Telegraph-Cable Company; Newcomb Carlton, president of the Western Union Telegraph Company; F. B. MacKinnon, vice president, United States Independent Telephone Association, and N. C. Kingsbury, vice president, American Telephone and Telegraph Company.

At a conference held in Washington March 19 with the secretary of war, Gen. Kuhn of the General Staff and president of the War College, Gen. Squier, chief signal officer of the Army, and Commander Todd, director of communication for the Navy, each member of the Committee on Communication pledged the co-operation of the interests represented by him in whatever measures the Council of National Defence might see fit to adopt in utilizing the telephone and telegraph systems of the country in time of war or in preparation therefor.

The Committee on Communication has been created as a part of the Advisory Commission to the Council of National Defence for the purpose of bringing into close co-operative touch the various telephone and telegraph interests and to provide a committee of advisers to the War and Navy Departments for the use of the telephone and telegraph lines in time of war.

The Council of National Defence created by the last congress consists of Secretary of War Baker, chairman; Secretary of the Navy Daniels, Secretary of the Interior Lane, Secretary of Agriculture Houston, Secretary of Commerce Redfield, Secretary of Labor Wilson; and by the same act there was created an Advisory Commission to the Council of National Defence, which is made up as follows: Howard E. Coffin, Detroit; Daniel Willard, Baltimore; Bernard M. Baruch, New York, Julius Rosenwald, Chicago; Samuel Gompers, Washington, D. C.; Dr. F. T. Martin, Chicago, and H. T. Godfrey, Philadelphia. To Mr. Willard was assigned the Department of Transportation and Communication and Mr. Willard in turn asked Mr. Vail to serve as chairman of the Committee on Communication.

Active preparations are being made for mobilizing the telephone and telegraph industry in case of war. A signal corps is being so formed that the various employes of the telephone companies will be enlisted and utilized in their present positions as a part of the reserve force of the nation. Maps are being prepared, showing the location of all exchanges and the toll connections, ready for instant use should the occasion arise.

To Mr. MacKinnon, the representative of the Independent companies on the committee, falls the task of furnishing maps and data regarding the Independent companies. Doubtless Mr. MacKinnon will get in touch with every Independent company and explain to them what will be expected of the telephone companies should war be declared.

To the minds of many in time of war the only ones called upon for service are those who enlist in the Army and Navy and take part in the actual fighting. The war in Europe has demonstrated that many war measures are applied within the country itself and much has depended upon the telephone and telegraph employes for preventing plots and for enabling the government to keep in close touch with all parts of the country and with the supply depots, munitions factories and other necessary resources. Thus the telephone and telegraph systems of England, France, Germany and the other countries at war have become a vital part of the army systems. It is true that many men experienced in the handling of telephone apparatus will be needed with the Army in the field and doubtless a call will be issued for volunteers for such service but the great majority of telephone employes will be called upon to render their service to their country in the positions in which they now are and will be relied upon to a very great extent by the government for carrying on the war to a successful conclusion in the protection of the rights of the nation.

## Evolution in Public Utilities

We have been passing through experiences for twenty-five or thirty years past that have been more or less interesting and exciting and trying. As a result of these experiences I believe public utilities are on a better basis today, and still more promising for the immediate future, than they have ever been before, said W. W. Freeman at the Investment Bankers' Convention in Cincinnati.

There are perhaps three or four distinct eras in this evolution of the utilities. The first may be but briefly mentioned—the era of invention and of initial promoter or developer. Following that came the era of exploitation, of utilities generally, and this is the era with which so many of our friends among the public find so much fault; where attempts were made without restriction of any kind whatever as to the issue of securities or as to the payment of earnings to capitalize the privilege of serving the public, and to utilize that privilege for the mere purpose of extorting from the public all that could possibly be secured and paying out to the promoters the spoils. That seems to have been the conception of the average individual with regard to this era of exploitation of public utilities.

We must confess, of course, that there was no restriction imposed by law upon the issue of securities, and that what happened was very largely the result of the capacity and the ingenuity of the promoter and the operator in each individual case.

Then came the era of regulation on the part of the public and the attempt to do away with all of the abuses of the past, protecting both the investor and the consumer as to rates and to service; and, while the theory of regulation is absolutely sound, and is for the interest of the investor no less than for the interest of the public, I am forced to the conclusion from my own experience that what was in the public's mind generally, in imposing regulation upon utilities, was not the protection of the investor, but was to reduce the charges for service. It was because the general belief in the public mind was that rates were high and service was poor; that the people were being bled by public service corporations generally, and that these things would stop when regulation was imposed, that there was such a unanimous sentiment for the regulation of public utilities.

We have had regulation for a good many years, longer in some states than in others, and operators will tell you that they had experience in connection with regulations that have been interesting, and have been at times annoying, and unfortunate.

It is not the most pleasant thing in the world to have the power of life and death over your properties placed in the hands of men, however intelligent they may be, and sincere, who are absolutely unequipped from the standpoint of experience to undertake the duties suddenly imposed upon them, and operators will tell you, if they are frank, of repeated experiences where they had been told by those well-meaning people that theories which they themselves perhaps entertained years ago, but found to be fallacies, must be introduced in the operation of their properties.

However, we have struggled through, assuming the good intent of the public with regard to regulation. The principal point I wish to particularly emphasize is that regulation in general, eliminating certain individual cases, has failed to produce the result that it was intended to produce, so far as the general conception of the public was concerned; and regulation has served today more for the investor, in proportion to what was expected and intended than it has for the consumer, for the public.

As a first step in reducing rates, through regulation, the question of the valuation of properties was raised.

Valuations became popular and numerous in various parts of the country. Then came the discussion of the rate of return to which a company was entitled, and attempts were made to devise certain standards as to certain rates applicable generally. The fact is, that the valuation of properties, the application of the theories of regulation to the average properties throughout the country, has not served to reduce rates or to produce the results that were generally expected and intended. Now, the reason must be this, that, notwithstanding certain abuses that may have existed, notwithstanding the absence of restrictions, there were automatic restrictions to the financing and operating of these properties, which gave the public the protection of which they were not aware, and which they sought to change through regulation.

The rates for service of public utility companies have been more or less standard in all part of the country, varying occasionally in localities, but these standards, which were accepted, perhaps without a full appreciation of what they involved, and the necessity for rendering good service, have served, without the knowledge of the public, in giving them the full measure of protection to which they were entitled, and giving them as much protection as they have secured by their more modern methods.

Following this era of regulation, I believe that we are rapidly approaching finally one which I may perhaps call the era of recognition. I believe a new policy with respect to public utilities is forming in the public mind. I believe that policy can be accepted freely by the utilities and accepted by the public. The first admission in connection with that policy should be that the only excuse for a public utility in any community is the necessity for a public service; that without that necessity the organization of the public utility is not justified; that it is the primary function to serve the public, and not to make any particular sum of money; that standard of service gives the utility the dignity in the community, as a real necessary public servant, and to the extent to which it fulfils that function it is entitled to the credit of the community for being a faithful public servant. Also coupled with that duty of the utility to the community there is an equally strong duty on the part of the community to permit the utility a fair and reasonable return for the service which it renders, and the measure of what is a fair and reasonable return is not any definite percentage on the capital, but is over and beyond the necessary expenditure for first-class service, the sum which will enable the company to obtain readily all the capital which it needs to give to the community the very highest grade of service. That may be one rate of 1 per cent in one community and another rate of 1 per cent in another community.

I find that most reasonable people will agree to that basis, and by the elimination of a discussion of capitalization, elimination of the discussion of a definite rate of return, and the comparison of figures with other figures from all parts of the country that have no possible application, the basis of understanding seems practicable, which readily leads to amicable relations and satisfactory conditions.

# The Annual Bell Report

## *An Abstract of the A. T. & T. Company's Record for 1916*

At the end of the year 1916 the number of telephone stations which constituted the Bell system in the United States was 9,847,192, an increase during the year of 695,971, of which increase 577,380 were owned by Bell companies and 118,591 were Bell connected stations. Of the total number of stations in the system 6,545,490 were owned and operated by Bell companies and 3,301,702 by local, co-operative and rural Independent companies or associations having sublicense or connection contracts; the so-called connecting companies.

THE WIRE SYSTEM.

The total mileage of wire in use for exchange and toll service was at the end of the year 19,850,315 miles, of which 1,344,770 were added during the year. Of the total mileage 17,167,405 miles were exchange wires and 2,682,910 miles were toll wires. Ninety-three per cent of the total wire mileage is copper wire. 11,468,525 miles, or 58 per cent of the mileage, including 760,160 miles of toll wires, is in underground cables, and this percentage is steadily increasing. The underground conduits represent a cost of $101,100,000 and the cables in the conduits $121,900,000, a total in underground plant of $223,000,000.

During 1916, 25,153 miles of phantom circuits were added, making 221,994 miles of these phantom circuits at the end of the year.

The wire mileage owned and operated by connecting companies is not included in any of these figures. At the end of the year the approximate mileage of connecting companies' toll wires was 420,000 miles, which added to the 2,680,000 miles of toll wires operated by the Bell companies, makes a total of over 3,000,000 miles of such wires bringing together in one comprehensive, inter-communicating system all the cities and towns and practically all of the rural communities throughout the United States.

TRAFFIC.

Including the traffic over the long-distance line, but not including connecting companies, the daily average of toll connections was about 890,000, and of exchange connections about 28,530,000 as against corresponding figures in 1915 of 819,000 and 25,184,000; the total daily average for 1916 reaching 29,420,000, or at the rate of about 9,789,700,000 per year. This is an average of approximately 100 calls per year for every man, woman and child in the United States.

PLANT ADDITIONS.

The net amount added to plant and real estate by all the companies, excluding connecting companies, constituting our system in the United States during the year 1916 was $66,224,728, distributed as follows:

| | |
|---|---|
| Real Estate | $ 4,632,272 |
| Equipment | 16,138,004 |
| Exchange Lines | 25,601,588 |
| Toll Lines | 10,403,936 |
| Construction Work in Progress, etc. | 9,448,928 |
| | $66,224,728 |

PLANT ADDITIONS OF PREVIOUS YEARS.

The net amounts added in seventeen years have been as follows:

| | | | |
|---|---|---|---|
| 1900 | $31,619,100 | 1909 | $28,700,100 |
| 1901 | 31,005,400 | 1910 | 53,582,800 |
| 1902 | 37,336,500 | 1911 | 55,660,700 |
| 1903 | 35,368,700 | 1912 | 75,626,900 |
| 1904 | 33,436,700 | 1913 | 54,871,900 |
| 1905 | 50,780,900 | 1914 | 50,045,300 |
| 1906 | 79,366,900 | 1915 | 32,863,700 |
| 1907 | 52,921,400 | 1916 | 66,224,700 |
| 1908 | 26,637,200 | | |

making a total for the seventeen years of $796,048,900.

MAINTENANCE, DEPRECIATION AND RECONSTRUCTION.

During the year $84,906,000 was applied out of revenue to current maintenance and depreciation, an increase of $8,846,000 as compared with 1915. Current maintenance increased $3,752,000, averaging 3.9 per cent on the average plant in service, which compares with 3.7 per cent in 1915.

The provision for depreciation of plant during the year was $49,983,000, an average of 5.6 per cent of the cost of plant and an increase over 1915 of $5,094,300.

Plant which originally cost about $44,000,000, but which had reached its limit of serviceable life, was removed and replaced by new and improved construction, or sold, as compared with $42,000,000 in 1915. After deducting this amount less salvage from the provision for depreciation, the balance, about $25,000,000, increases the reserves for such depreciation and obsolescence, which must be provided for out of current expenses, but cannot be currently determined or expended. It is the continuing policy of the Bell System to provide out of earnings each year such amounts as represent the estimated wear and tear, obsolescence and inadequacy of plant accruing during that year, so that when any plant comes to be retired sufficient reserve has been gradually acquired to meet the loss of capital due to such retirement.

This principle is now generally accepted and the practice is firmly established by the accounting rules of the Interstate Commerce Commission and the various state commissions.

GROWTH AND PROSPECTS.

The general and unprecedented business activity of the country during the past year has thrown on the Bell System a heavy burden of traffic, taxing facilities to the utmost and necessitating the rapid increase of those facilities which is indicated by the statistics.

The 1916 program called for additions to plant aggregating about $57,000,000, and an expected gain of about 400,000 subscriber stations. The actual additions cost over $66,000,000, and the stations increased by over 577,000. This is the largest gain ever made in any year and the increase in traffic was greater than in any previous year. The toll wire mileage added also exceeded any previous year.

The continued policy of the Bell System is to construct *in advance* of actual needs, partly to provide for emergencies and partly for economical reasons to avoid frequent reconstruction. This policy has justified itself many times over during the past year. Even under the most favorable conditions the rush of new subscribers and the rapid increase in traffic would have been difficult to provide for. But in 1916 not only did the prices for raw materials average almost double their normal cost, but at times it was not possible to get them in the quantities required. In these circumstances the advance construction in cables, buildings and switchboards was of prime importance, meeting demands which could not otherwise have been met. Notwithstanding the great increase in cost of materials the average investment per station decreased during the year from $149 to $146. In consequence of this absorption into service of the surplus plant, the program of construction during 1917 must not only meet the expected growth in stations but must also provide for the restoration of the normal plant surplus in whole or in part.

Without these provisions for future growth and demands, the companies could not have provided for the traffic which was offered. As it was, the quality of the service was at times and in some places not quite up to the high standard set in recent years, yet at no time and at no place did it break down, and by the end of the year it was on substantially a normal basis.

The prospects for the current year indicate a continuing station gain and a heavy traffic. To provide for growth and restore normal surplus plant and necessary advance construction estimates of additions to plant during the year aggregate about $90,000,000, by far the largest program ever undertaken.

The funds for these expenditures have already been provided by the new financing explained elsewhere, and the construction work is proceeding rapidly.

OPERATING RESULTS.

The American Telephone and Telegraph Company and associated companies constitute one operating entity, and to understand or correctly determine the actual costs and charges of the telephone service and the ultimate distribution of the revenue, their accounts must be consolidated.

The following tables show the business for the year of the Bell Telephone System including the American Telephone and Telegraph Company and its associated holding and operating companies in the United States, but not including connecting Independent or sub-licensee companies, or the Western Electric Company except as investments in and dividends from those companies are included respectively in assets and revenue. All inter-company duplications are eliminated in making up these tables so that the figures represent the business of the system as a whole in its relations to the public.

The statement of earnings and expenses is presented this year in the form called for by the Interstate Commerce Commission's accounting system. In round figures the total operating revenues of the Bell System were $264,600,000, an increase of $30,151,000 or 12.9 per cent over last year. Of these revenues depreciation and maintenance consumed $84,556,000, an increase of $8,797,000 over 1915 or 11.6 per cent; traffic expenses con-

sumed $53,749,000, an increase of $7,963,000 or 17.4 per cent; commercial expenses, $25,699,000, an increase of $2,116,000 or 9.0 per cent; general and miscellaneous expenses, $11,902,000, an increase of $853,000 or 7.7 per cent; taxes assignable to operations, $14,916,000, an increase of $1,915,000 or 14.7 per cent.

Including $215,000 taxes not assignable to operations the total taxes were $15,131,000, which is 1.70 per cent on the outstanding capital obligations. There were net non-operating revenues of $7,080,000, made up chiefly of interest, dividends and rents received less taxes and minor expenses connected therewith. The "total gross income," using the term officially provided by the Interstate Commerce Commission, was $79,353,000, an increase of $9,787,000 or 14.1 per cent over 1915. Out of this $22,114,000 was paid for interest, rents, etc., leaving $35,160,000 for dividends and over $22,000,000 to be carried into surplus.

Approximately $6,000,000 was paid to employes as additional compensation to cover the abnormal working and other conditions of the year. This payment was made late in the year, and should have been a charge against the expenditures of the year, as it covered construction, reconstruction, operation and all branches of the service, but it could not be allocated without restating the accounts of the whole year. The amount has therefore been charged against general surplus.

The total capitalization, including inter-company items and duplications but excluding reacquired securities of the companies of the Bell System, is $1,497,760,616. Of this, $608,333,979 is owned and in the treasury of the companies of the Bell System, and is represented to the public by the outstanding securities of the American Telephone and Telegraph Company and associated companies.

BELL TELEPHONE SYSTEM IN UNITED STATES.

*Comparison of Revenue and Expenses, 1915 and 1916. (All Duplications Including Interest, Dividends and Other Payments to American Telephone and Telegraph Company by Associated Companies Are Excluded.)*

| | 1915 | 1916 | Increase |
|---|---|---|---|
| Exchange Revenues | $169,155,944 | $188,888,149 | $19,732,205 |
| Toll Revenues | 62,929,980 | 72,971,668 | 10,041,688 |
| Miscellaneous Revenues | 2,338,431 | 2,715,463 | 377,032 |
| Total Operating Revenues | $234,424,355 | $264,575,280 | $30,150,925 |
| Depreciation | $ 44,586,841 | $ 49,631,966 | $ 5,045,125 |
| Current Maintenance | 31,171,272 | 34,923,549 | 3,752,277 |
| Traffic Expenses | 45,785,432 | 53,748,707 | 7,963,275 |
| Commercial Expenses | 23,583,274 | 25,698,913 | 2,115,639 |
| General and Miscellaneous Expenses | 11,049,191 | 11,902,470 | 853,279 |
| Total Operating Expenses | $156,176,010 | $175,905,605 | $19,729,595 |
| Net Operating Revenues | $ 78,248,345 | $ 88,669,675 | $10,421,330 |
| Uncollectible Revenues | $ 1,703,210 | $ 1,480,502 | *$ 222,708 |
| Taxes | 13,001,903 | 14,916,448 | 1,914,545 |
| Operating Income | $ 63,543,232 | $ 72,272,725 | $ 8,729,493 |
| Net Non-Operating Revenues | 6,022,932 | 7,080,384 | 1,057,452 |
| Total Gross Income | $ 69,566,164 | $ 79,353,109 | $ 9,786,945 |
| Rent and Miscellaneous Deductions | $ 3,384,407 | $ 3,735,470 | $ 351,063 |
| Interest Deductions | 18,095,643 | 18,378,931 | 283,288 |
| Total Deductions | $ 21,480,050 | $ 22,114,401 | $ 634,351 |
| Balance Net Income | $ 48,086,114 | $ 57,238,708 | $ 9,152,594 |
| Deduct Dividends | 32,897,065 | 35,160,119 | 2,263,054 |
| Surplus Earnings | $ 15,189,049 | $ 22,078,589 | $ 6,889,540 |

*Decrease.

The capital stock, bonds and notes payable of the Bell System *outstanding in the hands of the public at the close of the year were* $889,426,637, of which the outstanding securities of the American Telephone and Telegraph Company represent $596,092,719, and outstanding securities of the associated companies in the hands of the public represent $293,333,918.

If we consider the current accounts payable, $38,280,436, against which there were liquid assets, cash and current accounts receivable, of $146,722,409, or an excess of $108,441,973 to the credit of the system, it leaves *as the net permanent capital obligations* of the whole system outstanding in the hands of the public $780,984,664.

An appraisal made in 1912 by Bell engineers indicated that aside from all *intangible* assets, of tangible value, and without which neither this company nor any company could continue as a going concern, the cost of reproduction of these plants would exceed their book cost by about $61,000,000. This appraisal took the value of copper at only 17 cents per pound whereas it now costs about 35 cents per pound.

A number of appraisals in the various cities and states have been made by public authorities practically all of which have agreed in finding that the fair value of the properties for rate-making purposes is greater than, and in most cases very much greater than the amounts carried on our books.

BELL TELEPHONE SYSTEM IN THE UNITED STATES.

*Combined Balance Sheets, 1915 and 1916. (Duplications Excluded.)*

| | Dec. 31, 1915 | Dec. 31, 1916 | Increase |
|---|---|---|---|
| *Assets.* | | | |
| Telephone Plant | $ 880,068,520 | $ 946,293,248 | $ 66,224,728 |
| Supplies, Tools, etc. | 15,951,582 | 24,032,099 | 8,080,517 |
| Receivables | 43,518,625 | 66,029,580 | 22,510,955 |
| Cash | 45,716,330 | 80,692,829 | 34,976,499 |
| Stocks and Bonds | 72,652,646 | 81,815,476 | 9,162,830 |
| Total | $1,057,907,703 | $1,198,863,232 | $140,955,529 |
| *Liabilities.* | | | |
| Capital Stock | $ 440,711,200 | $ 463,101,569 | $ 22,390,369 |
| Funded Debts | 353,236,464 | 422,586,617 | 69,350,153 |
| Bills Payable | 2,404,920 | 3,738,451 | 1,333,531 |
| Accounts Payable | 29,039,127 | 38,280,436 | 9,241,309 |
| Total Outstanding Obligations | $ 825,391,711 | $ 927,707,073 | $102,315,362 |
| Employes' Benefit Fund | 9,114,329 | 9,151,000 | 36,671 |
| Surplus and Reserves | 223,401,663 | 262,005,159 | 38,603,496 |
| Total | $1,057,907,703 | $1,198,863,232 | $140,955,529 |

The telephone plants stand on the books of the companies at $946,293,248, as of December 31, 1916, a net increase during the year of $66,224,728, after deducting all plant withdrawn from service, sold or abandoned. Stocks and bonds owned increased during the year $9,162,830. Supplies, tools, etc., increased $8,080,517, due to the heavy construction program in progress. Receivables increased $22,510,955, of which $20,000,000 represented temporary investment of surplus cash on hand. Cash balances increased $34,976,499 to $80,692,829, which together with the temporary cash investments of $20,000,000, makes over $100,000,000 cash assets.

The increase in total assets of $140,955,529 is represented by $102,315,362 increase in oustanding obligations of the whole system and an increase in surplus and reserves of $38,640,167.

In accordance with previous practice in making up the combined figures for the Bell System, all inter-company items have been eliminated, and all intangible assets have been excluded, so that the combined surplus and reserves as shown are considerably less than the sum of surplus and reserves shown on the books of the separate companies.

The surplus and reserve, aggregating $262,000,000, is invested in tangible productive property, the revenue from which, being free from capital charges, is subject only to operating charges, and in this way reduces the cost of the service to the public. It is also a guaranty and protection to the future of the companies of the system, in that it is a provision against abnormal depreciation or obsolescence always possible in any going, progressive business involving so many and highly technical problems in mechanics and physics, for which, at some time, large capital would be necessary to replace the depreciated or obsolete plant.

BELL TELEPHONE SYSTEM IN UNITED STATES.

*Comparison of Revenue and Expenses, 1907 and 1916. (All Duplications Including Interest, Dividends and Other Payments to American Telephone and Telegraph Company by Associated Companies Are Excluded.)*

| | 1907 | 1916 | Increase |
|---|---|---|---|
| Gross Revenue | $128,579,800 | $270,400,892 | $141,821,092 |
| Expenses: | | | |
| Operation | 45,894,900 | 94,744,768 | 48,849,868 |
| Current Maintenance | 36,626,700 | 34,923,549 | 48,279,805 |
| Depreciation | | 49,982,956 | |
| Taxes | 4,873,400 | 15,131,980 | 10,258,580 |
| Total Expenses | $ 87,395,000 | $194,783,253 | $107,388,253 |
| Net Revenue | $ 41,184,800 | $ 75,617,639 | $ 34,432,839 |
| Deduct Interest | 10,508,500 | 18,378,931 | 7,870,431 |
| Balance Net Income | $ 30,676,300 | $ 57,238,708 | $ 26,562,408 |
| Deduct Dividends Paid | 18,151,700 | 35,160,119 | 17,008,419 |
| Balance for Surplus | $ 12,524,600 | $ 22,078,589 | $ 9,553,989 |

*Combined Balance Sheets, 1907 and 1916. (Duplications Excluded.)*

| | Dec. 31, 1907 | Dec. 31, 1916 | Increase |
|---|---|---|---|
| *Assets.* | | | |
| Contracts and Licenses | $ 9,078,000 | ..... | *$ 9,078,000 |
| Telephone Plant | 502,987,900 | $ 946,293,248 | 443,305,348 |
| Supplies, Tools, etc. | 17,165,200 | 24,032,099 | 6,866,899 |
| Receivables | 29,584,500 | 66,029,580 | 36,445,080 |
| Cash | 24,869,600 | 80,692,829 | 55,823,229 |
| Stocks and Bonds | 29,448,300 | 81,815,476 | 52,367,176 |
| Total | $613,133,500 | $1,198,863,232 | $585,729,732 |
| *Liabilities.* | | | |
| Capital Stock | $291,095,400 | $ 463,101,569 | $172,006,169 |
| Funded Debts | 196,113,700 | 422,586,617 | 226,472,917 |
| Bills Payable | 45,175,700 | 3,738,451 | *41,437,249 |
| Accounts Payable | 19,436,600 | 38,280,436 | 18,843,836 |
| Total Outstanding Obligations | $551,821,400 | $ 927,707,073 | $375,885,673 |
| Employes' Benefit Fund | ..... | 9,151,000 | 9,151,000 |
| Surplus and Reserves | 61,312,100 | 262,005,159 | 200,693,059 |
| Total | $613,133,500 | $1,198,863,232 | $585,729,732 |

*Decrease.

AVERAGE OPERATING UNITS OF ASSOCIATED OPERATING COMPANIES.

The table with the above heading shows average operating revenues and expenses per station, operating ratios, unit plant cost, etc., of the associated operating companies (not including the American Telephone and Telegraph Company's long-distance lines), for the years 1895, 1900, 1910, 1915 and 1916.

Although there are objections to the use of the subscriber's station as a unit or standard, especially in comparisons of one part of the country with another, yet it is the best unit available and for general comparisons of the whole system from one year to another it gives some idea of the trend of the business.

It will be observed that both average earnings and average expenses per station which now vary slightly from year to year are very much less than in earlier years. The average expenses per station have been kept down, in spite of improved wages and increased taxes, by improved methods and greater efficiency in every branch of the service.

The decrease—from $69.75 in 1895 to $30.57 in 1916—in the *average rate of earnings per station* made possible by the improvements in apparatus and methods, is largely the result of "measured service," which places the use of the system within the reach of the many who can afford to pay for actual use of the service by them, or its value to them, but would not, possibly could not pay, and in any case should not be called on to pay, for more than their own service, or to pay any rate based on average use. Average use is very greatly increased because of the very large use made by some. The best and most complete answer to the demands for flat rates is that 75 per cent of the total subscribers of the Bell System pay less than the average rate for their telephone service. Any method of charge which does not call upon the large users for their proportion of the cost caused by their use is unjust to the great mass of subscribers and would prevent many from availing themselves of the service.

AVERAGE OPERATING UNITS OF ASSOCIATED OPERATING COMPANIES, 1895 TO 1916.

*(This Table Covers the Companies Owning All the Exchanges and Toll Lines of the Bell Telephone System Except the Long-Distance Lines of American Telephone and Telegraph Company.)*

*Average per Exchange Station.*

| | 1895 | 1900 | 1910 | 1915 | 1916 |
|---|---|---|---|---|---|
| *Earnings:* | | | | | |
| Exchange Service | $ 69.75 | $ 44.68 | $ 31.28 | $ 29.80 | $ 30.57 |
| Toll Service | 11.35 | 12.60 | 9.47 | 8.65 | 9.05 |
| Total | $ 81.10 | $ 57.28 | $ 40.75 | $ 38.45 | $ 39.62 |
| *Expenses:* | | | | | |
| Operation | $ 29.15 | $ 21.63 | $ 15.14 | $ 15.61 | $ 15.97 |
| Taxes | 2.23 | 2.37 | 2.00 | 2.02 | 2.16 |
| Total | $ 31.38 | $ 24.00 | $ 17.14 | $ 17.63 | $ 18.13 |
| Balance | $ 49.72 | $ 33.28 | $ 23.61 | $ 20.82 | $ 21.49 |
| Maintenance and Depreciation | 26.20 | 17.68 | 13.46 | 12.38 | 12.62 |
| Net Earnings | $ 23.52 | $ 15.60 | $ 10.15 | $ 8.44 | $ 8.87 |
| Per Cent Operation Expense to Telephone Earnings | 35.9 | 37.8 | 37.2 | 40.6 | 40.3 |
| Per Cent Telephone Expense to Telephone Earnings | 71.0 | 72.8 | 75.1 | 78.1 | 77.6 |
| Per Cent Maintenance and Depreciation to Average Plant, Supplies, etc. | 9.1 | 8.4 | 9.5 | 8.8 | 9.2 |
| Per Cent Increase Exchange Stations* | 15.7 | 26.5 | 11.8 | 6.9 | 9.7 |
| Per Cent Increase Miles Exchange Wire* | 15.9 | 33.2 | 12.0 | 6.8 | 6.9 |
| Per Cent Increase Miles Toll Wire* (excluding Long-Distance Lines) | 21.3 | 25.2 | 11.5 | .9† | 8.0 |
| Average Plant Cost Per Exchange Station (Exchange and Toll Construction, excluding Long-Distance Lines) | $260.00 | $199.00 | $142.00 | $138.00 | $135.00 |
| Average Cost Per Mile of Toll Wire (including Poles and Conduits, excluding Long-Distance Lines) | $ 81.00 | $ 71.00 | $ 66.00 | $ 70.00 | $ 67.00 |
| Per Cent Gross Telephone Earnings to Average Plant | 29.7 | 28.4 | 28.8 | 27.7 | 29.4 |
| Per Cent Total Net Earnings to Average Capital Obligations | 9.76 | 8.85 | 7.52 | 7.20 | 7.88 |
| Per Cent Total Net Earnings to Plant and Other Assets | 9.36 | 7.96 | 6.65 | 5.84 | 6.17 |
| Per Cent Paid Out on Average Capital Obligations | 5.13 | 6.10 | 6.01 | 5.88 | 5.85 |
| Per Cent Paid Out on Plant and Other Assets | 5.09 | 5.57 | 5.31 | 4.76 | 4.58 |

*Increase during year shown, over previous year.

†Small increase mainly due to increase in radius covered by exchange rates.

Particular attention is again directed to the percentage of net earnings and of dividend and interest disbursements of the associated operating companies to their total plant and other assets; also of taxes paid to the public:

| | |
|---|---|
| Percentage of net earnings to plant and other assets | 6.17 |
| Percentage of charges paid on capital to plant and other assets | 4.58 |
| Percentage of taxes paid to public to plant and other assets | 1.41 |

These percentages of earnings and charges compare with 5.84 per cent and 4.76 per cent in 1915. The increased percentage of net earnings for 1916 is not normal, being as it is due to the sudden increase in demands for service without a corresponding increase of plant, a condition under which service could not be satisfactorily given, and which could not be allowed to continue any longer than impossible to avoid. The decreased percentage of dividends and interest to investment reflects a lesser increase in average capital obligations than in plant due to the utilizing of surplus and unexpended reserves for additions to plant and other assets.

The amount distributed for interest and dividends on the outstanding obligations of the associated companies, out of their earnings, constitutes but a small per cent on their plant and other assets, and if the taxes paid are considered the percentage is less than that of any well-secured bond.

REPORT OF THE AMERICAN TELEPHONE AND TELEGRAPH COMPANY.

The statement of the expenses of the American Telephone and Telegraph Company represents only the cost of the maintenance of the central administration of the whole system, as explained elsewhere. The disbursements of dividend and interest represent the charges on the securities issued by the company to finance the associated companies and the long-distance lines.

The statement of earnings of the American Telephone and Telegraph Company represents, in addition to the net receipts of the long-distance lines, only that part of the earnings of the Bell System which is received by the American Telephone and Telegraph Company, out of the divisible surplus of the associated companies from operation, as interest or dividends on money advanced by the company to finance the associated companies, or as payments by the associated companies to maintain the central administration.

EARNINGS.

The net earnings of the American Telephone and Telegraph Company for the year were $44,743,376.45, which is $3,625,889.17 more than for the previous year. The interest charges were $6,730,098.86 and the dividends at the regular rate of 8 per cent per annum were $31,122,187.46. Of the resulting balance there was carried to Reserves $2,500,000 and to Surplus $4,391,090.13.

BALANCE SHEET.

The balance sheet of the American Telephone and Telegraph Company is given as usual at the end of this report. By comparison with the previous year's balance sheet it will be noticed that the investment in stocks, bonds and notes of associated companies increased $21,845,830.60 and in permanent plant, $5,041,396.54, a total of $26,887,227.14.

The account "Trustees-Employes' Stock Purchase Plan," $9,153,950.43, represents the balance on advances made to the trustees to acquire stock which they sold to employes on the plan of easy payments explained in previous reports, less the payments on that account received from employes. The increase is due to the additional stock sold employes in March, 1916.

An increase in current assets of $37,185,134.56 and in cash of $35,367,105.52 reflects the new financing in December, 1916.

On the other side, under liabilities, the increase in capital stock outstanding of $15,126.500 represents chiefly stock issued in exchange for convertible bonds. Capital Stock Installments of $32,019 represent advance payments for shares to be issued in 1917 under the offer of new stock referred to elsewhere. The total indebtedness increased $77,821,332.90, the noteworthy item under this head being the $80,000,000 bonds issued December 1, 1916, hereinafter described.

For the total increase in assets of $99,797,450.06 there was a net increase in capitalization and indebtedness of $92,979,851.90, showing a net improvement in the company's financial position of $6,817,598.16 which is represented by the increase of that amount in surplus and reserves.

CAPITAL STOCK AND BONDS.

During the year, $14,173,600 of the 4½% convertible bonds were converted into stock at the ratio of $120 in bonds, or $100 in bonds and $20 in cash, for one share of stock. Nearly all the conversions were on the latter basis. Of the $67,000,000 bonds issued in 1913 there were left outstanding at the end of the year only $13,890,100.

Of the 4% convertible bonds $1,002,000 were converted during the year, leaving outstanding $3,127,000. Of the $15,126,500

capital stock issued during the year, $14,728,700 was issued in exchange for convertible bonds and $397,800 was treasury stock sold for cash.

As of February 1, 1916, the company sold $40,000,000 of its two-year 4½% coupon notes and $10,000,000 similar notes of associated companies bearing the endorsement of the company. It was arranged that up to April 1, 1916, there might be substituted for any part of the American Telephone and Telegraph Company's notes an equal amount of associated companies' notes endorsed by the company, and substitutions to the amount of $18,390,000 were duly made, so that there were finally outstanding, $21,610,000 of the company's notes and $28,390,000 of associated companies' notes endorsed by the company. The company has since reacquired and cancelled $6,155,000 of its own notes of this issue, so that at December 31, 1916, there were outstanding as shown by its balance sheet $15,455,000 of its own notes. The company has also acquired and carries $5,941,000 of these associated companies' notes due February 1, 1918, leaving outstanding $22,449,000 of the issue which bear its endorsement. There are also outstanding endorsed by this company $1,610,000 associated companies' notes due February 1, 1918, and $10,650,000 notes of the 195 Broadway Corporation due July 1, 1920, which corporation owns the real estate in New York City where the company's offices are now located.

To meet the financing by the company of the associated operating companies and for other purposes, the company sold, as of December 1, 1916, $80,000,000 of 30-year 5% collateral trust gold bonds. Capital stock of the following companies of the par values shown has been deposited with the Old Colony Trust Company, Trustee, as collateral security for this issue of bonds:

| | |
|---|---|
| New England Tel. & Tel Co., par value | $10,900,000 |
| New York Telephone Co., par value | 34,462,000 |
| Southern Bell Tel. & Tel. Co., par value | 12,208,700 |
| Southwestern Tel. & Tel. Co., par value | 23,377,000 |
| Pacific Tel. & Tel. Co. (preferred shares), par value | 13,600,000 |

The estimated value of these shares exceeds $107,000,000. Provisions are made for the redemption of all or any part of the bonds at 105 per cent of their par value at the company's option on sixty days' notice, and for a sinking fund of one per cent per annum.

The total outstanding capital stock and bonds of the American Telephone and Telegraph Company at December 31, 1916, were as follows:

| | |
|---|---|
| Capital stock | $395,603,600 |
| 4% Collateral trust bonds, 1929 | 78,000,000 |
| 4% Convertible bonds, 1936 | 3,127,000 |
| 4½% Convertible bonds, 1933 | 13,890,100 |
| 5% Western Tel. and Tel. bonds, 1932 | 9,985,000 |
| 5% Collateral trust bonds, 1946 | 80,000,000 |
| Total | $580,605,700 |

For the $395,603,600 capital stock $430,377,852.74 has been paid into the treasury of the company; the $34,774,252.74 in excess of par value representing premiums on stock which are included as part of the company's surplus.

All discounts on bond and note issues are deducted in determining the net surplus as shown in the balance sheet.

The number of shareholders, not including employes purchasing stock under the plan of easy payments, was 70,555 on December 31, 1916, and shows an increase of 5,043 during the year. That the distribution continues to be more general appears from the following:

62,090 held less than 100 shares each;
8,064 held from 100 to 1,000 shares each;
367 held from 1,000 to 5,000 shares each;
20 held 5,000 shares or more each (omitting brokers, holders in investment trusts, etc.).

Of the holders of less than 100 shares each,
15,003 held 5 shares or less each;
46,845 held 25 shares or less each.

The average number of shares held was 56, or deducting the stock held by trustees under the Employes' Stock Purchase Plan the average was 54 shares.

A majority of the company's shareholders are women. Less than 5 per cent of the stock was at December 31 in the names of brokers and less than 2 per cent of all the stock is held in Europe.

To the 70,555 stockholders of record shown above there should be added some 43,000 employes of the Bell System in all parts of the country who are paying for stock out of their wages at the rate of $2 per share per month. Counting these and also those persons whose stock is held for them in investment trusts and the like, there are probably at least 120,000 actual owners of stock in this company.

FINANCING FOR 1917.

In addition to the issue of $80,000,000 30-year 5% collateral trust bonds in December, 1916, shareholders had the right to subscribe to shares of new stock in the proportion of one share for every ten shares outstanding as of December 11, 1916. The rights to subscribe expired on January 22, 1917, and practically all the stock offered, $39,550,600, was subscribed for.

ENGINEERING.

During the year, notwithstanding the delays and difficulties which have been experienced in all industries in conducting engineering and construction work, important progress has been made in applying improvements in construction and equipment to the telephone plant of the Bell System. These improvements have made intra-continental and transcontinental telephonic transmission of speech a commercial actuality, and have also shown that inter-continental speech transmission is a probability within the limitations of the natural physical conditions. These improvements in lines and equipment have increased the range of telephonic speech transmission many fold, and already the cities in the United States of over 50,000 inhabitants, with most of their adjacent and connected towns and territory, have been placed in speaking communication with each other, and brought into the range of extra long-distance service.

These improvements which have been in trunk-line construction and in the intermediate and auxiliary apparatus were so adapted to that existing, that there have been necessary only slight material changes in the line, switchboard or substation equipment of the Bell System with its millions of subscribers and hundreds of millions of plant.

The economic value of this in saving and in results to the public and to the Bell System is impossible to compute, but is enormous.

The value of these improvements not only to the commercial interests of the country, but in the problem of national defense, was demonstrated during a mobilization of communication forces conducted by the staff of the company at the request of the secretary of the navy and in co-operation with naval officers under the command of Admiral W. S. Benson, chief of naval operations. For three days, during which war conditions were simulated as far as possible, the navy abandoned all other forms of communication between the Navy Department at Washington and the navy-yards and naval stations in the continental United States, and utilized the Bell System for telephone and telegraph communications by wire with all of the naval forces in that territory. The service of the Bell System is continuous, that it, it covers the full 24 hours. During the period of mobilization, naval officers and the telephone officials assigned to the work were on duty day and night, and at all times could obtain instantaneous telegraph or telephone communication with any point involved in the mobilization. The secretary of the navy himself conversed with a number of the principal naval stations, and the admiral in command personally talked to the commanding officer at all of the naval stations on the Pacific Coast from Bremerton, Washington, to San Diego, California, and to the navy-yards and naval stations on the Gulf and Atlantic coasts and on the Great Lakes.

While the mobilization was intended primarily to test the efficiency of the wire system in time of war, an interesting test of wireless telephony was made. The transmission was by wire to the wireless stations, where it was automatically transferred to wireless, or vice versa.

The secretary of the navy, seated at his desk in the Department at Washington, talked with Captain Chandler on board the battle-ship *New Hampshire* at Hampton Roads.

Under orders given to him by the secretary of the navy and Admiral Benson, the captain of the *New Hampshire* proceeded out to sea as far as the Southern Drill Grounds and returned, reporting his position by telephone every hour to the department at Washington.

The atmospheric electrical conditions being very favorable, the talking to and from the ship was so loud and distinct that Captain Bennett, in command at the Mare Island Navy Yord on the Pacific, conversed with Captain Chandler on the *New Hampshire*, which was at that time in a storm on the Atlantic. This conversation was transmitted over the transcontinental telephone wire circuit from Mare Island, California, to the radio station at Arlington, Virginia, and there transferred automatically to the wireless from Arlington to the ship at sea, the return conversation taking the opposite course.

The results of this mobilization were most satisfactory to the secretary of the navy, the naval officers, and the telephone officials, as it demonstrated on the part of the plant and organ-

ization of the Bell System complete readiness to respond to the requirements of the national defense should an emergency arise.

During the year important work has been done in co-operation with the officers of the Signal Corps of the army, in planning for the best way of making use of the plant and organization of the Bell System in case of military necessity.

Enough has already been done to make certain that the co-operation and assistance which can be given by the Bell System to the army whenever necessary will be even more varied and more extensive than that required by the navy.

In the handling of traffic over these extra long lines, as well as in their maintenance, new operating methods have been required, that the operators might be able to connect or join together correctly and promptly the numerous sections of line required to make up the long and complicated speaking circuits. Traffic engineers are successfully meeting these new conditions. During the year, in co-operation with the associated companies, they have studied the traffic conditions in all of the cities of the United States. They have reviewed the operating conditions and have introduced many improvements which have been of the greatest benefit to the service, both long distance and local.

The making of development studios and fundamental plans, being the foundation work upon which all construction engineering plans are based, formed as usual an important part of the year's work. Such plans have been completed for Boston, Baltimore, Chattanooga, Detroit, Duluth, Grand Rapids, New Orleans, Pittsburgh, and Springfield, Mass. In the case of plans for a number of other places important progress has been made.

The further adoption of electric traction by railroads and the continued extension of electric power lines have been the occasion of great activity on the part of our engineers in studying the difficult problems of telephone operation in the neighborhood of these circuits. Co-operation with the California Railroad Commission in its exhaustive investigation into the subject of these interferences has been continued during the year, and co-operative work with the United States Bureau of Standards and with state commissions in Illinois, Iowa, Nebraska, and Wisconsin, in connection with rules governing the operation of such wires. Important field investigations were conducted in connection with power lines in Iowa, the electrification of the Pennsylvania Railroad, that of the Chicago, Milwaukee & St. Paul Railway, and others.

The company has co-operated with the American Institute of Electrical Engineers in work looking to the development of apparatus to be used by the power companies in lessening the disturbance which they produce, and important bulletins and circular letters embodying valuable information relating to the whole subject of disturbances have been sent to the associated companies.

In co-operation with the insurance department of the company attention has been given to the matter of improving the fire protection for central offices, and to methods whereby the most favorable insurance rates may be obtained. Acting in co-operation with the engineers the insurance department has made during the year 400 important inspections of telephone central offices, which resulted in many suggestions helpful to the associated companies.

In new central office building construction, the year has been unusually active, general building and equipment plans for 24 new buildings have been worked out by the department in co-operation with the associated companies. When completed and filled with the equipment contemplated, the expenditures, based upon these plans, would be something over $22,000,000.

Hundreds of new inventions and patents have been studied and tested, and attention has been given to almost every one of the parts making up the complex plant, to see how they might be improved, with the result that an unusually large number of improvements have been introduced in cable, switchboard, substation and other apparatus, resulting in substantial advances or economies in the operating, maintenance or construction of the plants of the associated companies.

LEGAL.

The year 1916 has marked substantial progress in the important work of the legal department arising out of the commission regulation. Telephone companies are subject to regulation by the Interstate Commerce Commission; all but four of the states have created local commissions which exercise jurisdiction more or less complete over them. The subjects to which the jurisdictions of the commissions extend embrace rates, service, accounting, financing and capitalization. While commission regulation has not yet progressed beyond the development stage and this will probably be true of it for a number of years, it has gone far enough to warrant the statement that substantial progress has been made toward sound results. The persistent policy of the company has been to co-operate with the various commissions, and so far as practicable to aid them in solving the problems that are presented, along the sound and just economic lines which must form the basis of any permanent success in the regulation of public utilities. To this end, it has been the constant purpose of the legal department to ascertain and establish the fundamental legal and economic propositions which must underlie sound regulation, and to present these principles clearly and forcibly to the various commissions.

It is worth nothing that the development of the work of the commissions manifests an increasing appreciation by them of their responsibilities and a growing earnestness in their efforts to reach the right solutions of the questions presented to them.

In valuations, the present disposition of the commissions is to allow, without serious controversy, the items which are susceptible of direct and certain proof. The so-called intangibles represent elements of value which must be recognized as of large importance. The proof to establish them in the very nature of things lacks the certainty which may be attained as to so-called physical factors. It necessarily must rest largely upon the judgment of individuals. This tends to uncertainty and has surrounded the measurement of these items with difficulties. The disposition has been to recognize them as elements of value and to allow them, in one form or another, so far as they have been clearly established.

A question of growing importance arises out of the distinction between regulation and management. The power of the state to regulate is beyond question. It is just as well settled that this power is not broad enough to include the power to manage. This is something that inheres in the ownership of the property and belongs to the utility itself. Where it has been brought to their attention, the tendency of the commissions has been frankly to recognize this distinction. The fact that cases may arise where it will be difficult to draw the line between management and regulation does not mean that there is no such distinction. The distinction between negligence and due care is universally recognized, although many cases arise which it is difficult to assign to one side or the other of the line. During the year that has just closed an especial effort has been made to draw attention to this distinction between regulation and management because it is felt that a failure to recognize it would result in serious embarrassment not only to the utilities but to the public as well. Not good, but harm, would result from an attempt on the part of regulation to absorb what properly belongs to management.

As to the many questions of service which have arisen, co-operation with the commissions has in the majority of cases removed all differences and resulted in conclusions which have been accepted by the companies without impairment of their service.

Each of the associated companies maintains its own legal department and performs for itself the services which are ordinarily assigned to such a department. This work the legal department of the American Company does not attempt to do. Its function as a part of the central organization is, in a sense, to act as counsel for the various counsel for the associated companies, and to render to them such assistance as they may require in the transaction of their affairs.

This assistance may be general, as in the publication of periodical bulletins intended to advise counsel for the associated companies as to current decisions of special interest by the courts and by commissions, or it may be special, in relation to unusual or important transactions which may arise in connection with the affairs of the associated company.

It is the purpose of the legal department of the American Company to keep sufficiently in touch with the legal affairs of the entire system to be assured that the experience of the entire system shall be available for the benefit of each part of it and that all questions of a general nature, as well as all questions of policy, in which the system as a whole is concerned, shall be disposed of along sound and consistent lines.

A striking indication of the continuous development of the telephonic art lies in the fact that it has been necessary to supplement the patent division of the legal department which has always been located in Boston, by an additional force at the office in New York. The patent division in conjunction with the engineering department has done much efficient and important work during the year that has just ended.

The situation as to pending litigation is practically unchanged. The amount of the current litigation is wholly unimportant. It is true now, as it has been at the times of the making of the last two reports to the stockholders, that no suit is pending against this company or any of its associated companies charging any violation of any state or federal anti-trust law. No such suit has been brought since the making of the last report.

CONDENSED STATISTICS OF THE BELL TELEPHONE SYSTEM.

| | Dec. 31, 1895. | Dec. 31, 1900 | Dec. 31 1905. | Dec. 31, 1905. | Dec. 31, 1915. | Dec. 31, 1916. | Increase. |
|---|---|---|---|---|---|---|---|
| Total Miles of Pole Lines | 78,203 | 131,538 | 213,233 | 282,877 | 330,602 | 337,289 | 6,687 |
| Miles of Underground Conduit (length of single duct) | ..... | ..... | ..... | 30,165 | 44,510 | 47,120 | 2,610 |
| Miles of Underground Wire | 184,515 | 705,269 | 2,345,742 | 5,992,303 | 10,536,837 | 11,468,525 | 931,688 |
| Miles of Submarine Wire | 2,028 | 4,203 | 9,373 | 24,636 | 36,314 | 41,172 | 4,858 |
| Miles of Aerial Wire | 488,872 | 1,252,329 | 3,424,803 | 5,625,273 | 7,932,394 | 8,340,618 | 408,224 |
| Total Miles of Wire | 675,415 | 1,961,801 | 5,779,918 | 11,642,212 | 18,505,545 | 19,850,315 | 1,344,770 |
| Comprising Toll Wire | 215,687 | 607,599 | 1,265,236 | 1,963,994 | 2,453,483 | 2,682,910 | 229,427 |
| Comprising Exchange Wire | 459,728 | 1,354,202 | 4,514,682 | 9,678,218 | 16,052,062 | 17,167,405 | 1,115,343 |
| Total | 675,415 | 1,961,801 | 5,779,918 | 11,642,212 | 18,505,545 | 19,850,315 | 1,344,770 |
| Miles of Phantom Circuit | ..... | ..... | ..... | 115,506 | 196,841 | 221,994 | 25,153 |
| Total Exchange Circuits | 237,837 | 508,262 | 1,135,449 | 2,082,960 | 3,174,271 | 3,459,069 | 284,798 |
| Number of Central Offices | 1,613 | 2,775 | 4,532 | 4,933 | 5,300 | 5,397 | 97 |
| Number of Bell Stations (Owned)* | 309,502 | 835,911 | 2,282,378 | 3,933,056 | 5,968,110 | 6,545,490 | 577,380 |
| Number of Bell Connected Stations | ..... | 20,000 | 246,337 | 1,949,663 | 3,183,111 | 3,301,702 | 118,591 |
| Total Stations | 309,502 | 855,911 | 2,528,715 | 5,882,719 | 9,151,221 | 9,847,192 | 695,971 |
| Number of Employes | 14,517 | 37,067 | 89,661 | 120,311 | 156,294 | 179,032 | 22,738 |
| Number of Connecting Companies, Lines and Systems | ..... | ..... | ..... | 17,845 | 28,306 | 30,358 | 2,052 |
| Exchange Connections Daily | 2,351,420 | 5,668,986 | 13,543,468 | 21,681,471 | 25,183,799 | 28,530,073 | 3,346,274 |
| Toll Connections Daily | 51,123 | 148,528 | 368,083 | 602,539 | 819,030 | 889,860 | 70,830 |

*Includes Private Line Stations.

COMBINED BALANCE SHEETS AT FIVE YEAR INTERVALS, 1885-1916.

| ASSETS: | Dec. 31, 1885. | Dec. 31, 1890. | Dec. 31, 1895. | Dec. 31, 1900. | Dec. 31, 1905. | Dec. 31, 1910. | Dec. 31, 1915. | Dec. 31, 1916. |
|---|---|---|---|---|---|---|---|---|
| Contracts and Licenses | $16,732,100 | $18,925,700 | $ 20,005,300 | $ 14,794,300 | $ 13,313,400 | $ 2,943,381 | $..... | $..... |
| Telephone Plant | 38,618,600 | 58,512,400 | 87,858,500 | 180,699,800 | 368,065,300 | 610,999,964 | 880,068,520 | 946,293,248 |
| Supplies, Tools, etc | 348,500 | 1,021,800 | 1,810,000 | 6,464,400 | 11,069,500 | 20,987,551 | 15,951,582 | 24,032,099 |
| Receivables | 1,450,900 | 1,761,600 | 3,746,600 | 13,644,000 | 26,220,800 | 26,077,802 | 43,518,625 | 66,029,580 |
| Cash | 1,792,600 | 1,183,300 | 2,484,100 | 3,223,000 | 11,005,900 | 27,548,933 | 45,716,330 | 80,692,829 |
| Stocks and Bonds | 1,138,800 | 2,697,400 | 4,480,500 | 11,400,400 | 23,041,200 | 64,766,089 | 72,652,646 | 81,815,476 |
| Total | $60,081,500 | $84,102,200 | $120,385,000 | $230,225,900 | $452,716,100 | $753,323,720 | $1,057,907,703 | $1,198,863,232 |
| LIABILITIES: | | | | | | | | |
| Capital Stock | $38,229,200 | $43,792,800 | $ 57,462,700 | $130,006,900 | $238,531,100 | $344,645,430 | $ 440,711,200 | $ 463,101,569 |
| Funded Debts | 367,400 | 6,473,100 | 10,074,100 | 44,137,900 | 93,079,500 | 224,791,696 | 353,236,464 | 422,586,617 |
| Bills Payable | 2,618,900 | 1,323,000 | 2,000,000 | 7,000,000 | 35,000,000 | 42,566,943 | 2,404,920 | 3,738,451 |
| Accounts Payable | | 3,301,100 | 6,138,000 | 13,583,300 | 22,407,500 | 21,721,125 | 29,039,127 | 38,280,436 |
| Total Outstanding Obligations | $41,215,500 | $54,890,000 | $ 75,674,800 | $194,728,100 | $389,018,100 | $633,725,194 | $ 825,391,711 | $ 927,707,073 |
| Employees' Benefit Fund | ..... | ..... | ..... | ..... | ..... | ..... | 9,114,329 | 9,151,000 |
| Surplus and Reserves | 18,866,000 | 29,212,200 | 44,710,200 | 35,497,800 | 63,698,000 | 119,598,526 | 223,401,663 | 262,005,159 |
| Total | $60,081,500 | $84,102,200 | $120,385,000 | $230,225,900 | $452,716,100 | $753,323,720 | $1,057,907,703 | $1,198,863,232 |

COMPARATIVE REVENUE AT FIVE YEAR INTERVALS, 1885-1916.

| | Year 1885. | Year 1890. | Year 1895. | Year 1900. | Year 1905. | Year 1910. | Year 1915. | Year 1916. |
|---|---|---|---|---|---|---|---|---|
| Gross Revenue | $10,033,600 | $16,212,100 | $24,197,200 | $46,385,600 | $97,500,100 | $165,612,881 | $239,909,649 | $270,400,892 |
| Expenses | 5,124,300 | 9,067,600 | 15,488,400 | 30,632,400 | 66,189,400 | 114,618,473 | 173,727,892 | 194,783,253 |
| Net Revenue | $ 4,909,300 | $ 7,144,500 | $ 8,708,800 | $15,743,200 | $31,310,700 | $ 50,994,408 | $ 66,181,757 | $ 75,617,639 |
| Interest | 27,700 | 278,700 | 655,500 | 2,389,600 | 5,836,300 | 11,556,864 | 18,095,643 | 18,378,931 |
| Net income | $ 4,881,600 | $ 6,865,800 | $ 8,053,300 | $13,363,600 | $25,474,400 | $ 39,437,544 | $ 48,086,114 | $ 57,238,708 |
| Dividends | 3,107,200 | 4,101,300 | 5,066,900 | 7,893,500 | 15,817,500 | 25,160,786 | 32,897,065 | 35,160,119 |
| Balance for Surplus | $ 1,774,400 | $ 2,764,500 | $ 2,986,400 | $ 5,470,100 | $ 9,656,900 | $ 14,276,758 | $ 15,189,049 | $ 22,078,589 |

AMERICAN TELEPHONE AND TELEGRAPH COMPANY BALANCE SHEET, DECEMBER 31, 1916.

| LIABILITIES. | | | ASSETS. | | |
|---|---|---|---|---|---|
| Capital Stock | $395,603,600.00 | | Stocks of Associated Companies | $452,390,925.92 | |
| Capital Stock Installments | 32,019.00 | $395,635,619.00 | Bonds and Notes of Associated Companies | 68,088,355.35 | $520,479,281.27 |
| 4% Collateral Trust Bonds, 1929 | $ 78,000,000.00 | | Telephones | $ 16,779,577.51 | |
| 5% Collateral Trust Bonds, 1946 | 80,000,000.00 | | Real Estate | 508,400.42 | |
| 5% Western Tel. & Tel. Co. Bonds, 1932 | 9,985,000.00 | | Office Furniture and Fixtures | 215,902.25 | |
| 4% Convertible Bonds, 1936 | 3,127,000.00 | | Long Distance Telephone Plant | 53,457,978.24 | 70,961,858.42 |
| 4½% Convertible Bonds, 1933 | 13,890,100.00 | | | | |
| 4½% Coupon Notes, 1918 | 15,455,000.00 | | Trustees—Employees' Stock-Purchase Plan | | 9,153,950.43 |
| Notes to Associated Companies | 1,700,000.00 | 202,157,100.00 | Special Demand Notes | $ 21,520,000.00 | |
| | | | Current Accounts Receivable | 15,408,692.94 | 36,928,692.94 |
| Dividend Payable January 15, 1917 | $ 7,912,072.00 | | | | |
| Interest and Taxes accrued, but not due | 2,783,840.53 | | Temporary Cash Investments | $ 20,000,000.00 | |
| Current Accounts Payable | 2,177,966.23 | 12,873,878.76 | Cash and Deposits | 65,237,660.70 | 85,237,660.70 |
| Employees' Benefit Fund | | 2,000,000.00 | | | $722,761,443.76 |
| Reserves for Depreciation and Contingencies | | 31,092,679.88 | | | |
| Surplus (including Capital Stock Premiums and excluding Debt Discount and Expense) | | 79,002,166.12 | | | |
| | | $722,761,443.76 | | | |

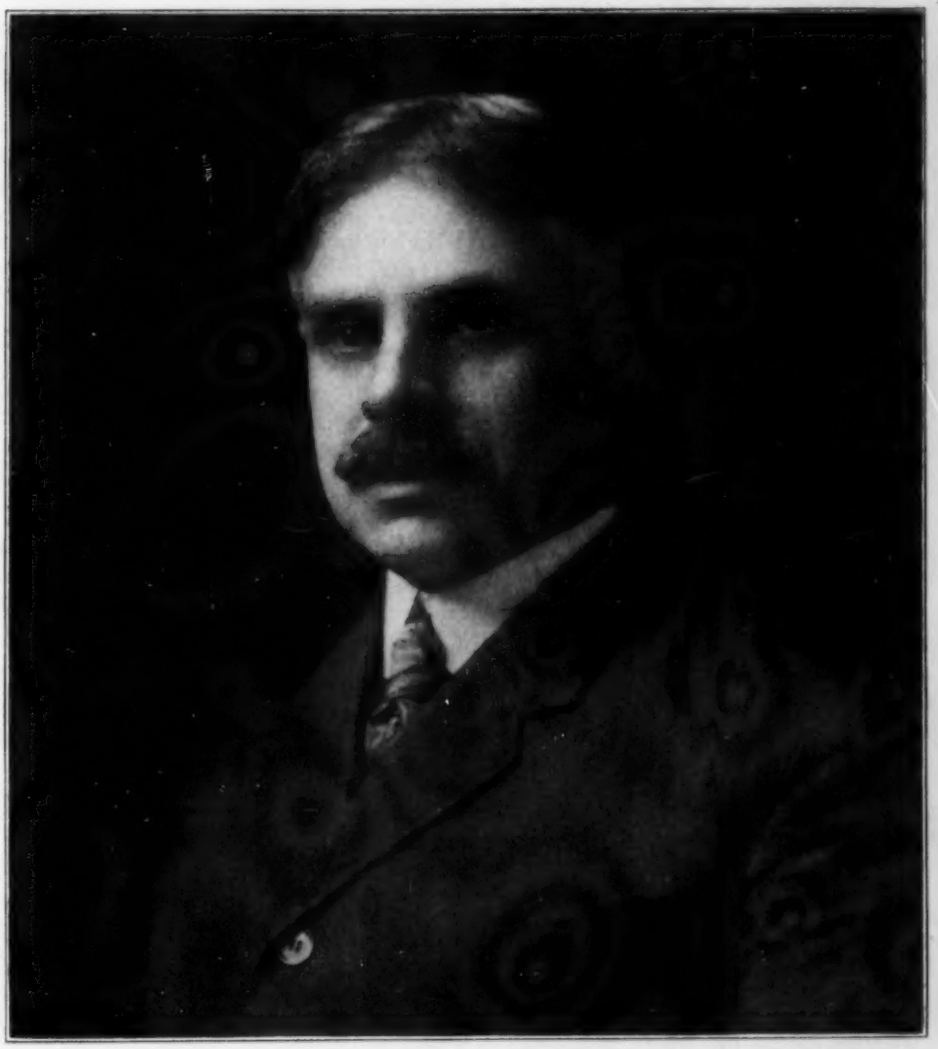
Note: $34,709,000.00 Coupon Notes of Associated Companies, endorsed but not owned by this Company, are not included above in either Assets or Liabilities.

A laboratory is being fitted up at the radiographic station at the Darsena Norte, Argentina, for the purpose of making experiments in radiotelephony. It is hoped to be able to effect communication over a distance of 200 miles.

Rockwell L. Holden, Chicago Telephone Company, has asked Superintendent of Schools Shoop for lists of high school graduates with a view to employing them in the long distance service. Mr. Shoop has recommended the request be granted.

# The Indianapolis Cut-Over

## *Indiana Metropolis is Now Automatic*



*William Fortune, President of the Indianapolis Telephone Company.*

TO telephone men the recent cut-over of the automatic equipment installed by the Indianapolis Telephone Company stands out as one of the most successfuly undertakings of its kind to be found in the annals of telephony. The cut-over took place on Saturday night, March 17, and the first day of the automatic telephone service saw it carry with great success a load three times as heavy as the normal day's traffic. Less than 36 hours after the cut-over, Governor Goodrich of Indiana and Governor Cox of Ohio furnished the world with a most striking demonstration of the immediate and thorough success of the work.

Governor Goodrich, sitting at his desk in Indiana's State Capitol, dialled his automatic telephone and by means of the long distance connection was able to get into conversation with Governor Cox of Ohio in 10 seconds. The two governors both expressed their delight at the splendid talking qualities of the automatic, and this is the more noteworthy since they are using instruments and apparatus quite different in type. In other words, while all the Indianapolis equipment is the very latest in model and construction, having been turned out by the Automatic Electric Company since last June, the Columbus, Ohio, equipment is over thirteen years old, having been installed in 1904. Notwithstanding this difference, the two types of apparatus worked in perfect harmony.

Indianapolis has given the new automatic telephone system a wonderfully cordial reception. Ever since the cut-over there has been a remarkable daily gain of new subscribers and on the days immediately following the cut-over practically every local advertiser used a picture of the automatic telephone in his newspaper displays, giving his automatic telephone number, and encouraging the public to use the automatic in communicating with his place of business. On the Monday following the change, Indianapolis people coming to work on the street cars were informed by large window cards in almost every place of business: "Yes! We Have the Automatic Telephone."

The Indianapolis installation establishes a record for large scale production of automatic equipment, for it was only nine months ago that the initial order was placed with the Automatic Electric Company. This company, parent of the automatic telephone, was deep in other large orders, but under pressure succeeded in turning out the finished equipment so steadily and rapidly that the installation went forward with never a delay, and the cut-over came off on the scheduled time. There were almost 13,000 lines equipped at the time of the cut-over, and at the present rate of growth the number of subscribers will probably increase to 20,000 or more before the additions of new lines and central office equipment can be halted or even slackened.

It was at first planned to spend about $400,000 in improving the service of the Indianapolis Telephone Company, but so encouraging has been the public's approval of the automatic from the very first announcement, that President William Fortune and his fellow officers and directors of the Indianapolis Telephone Company decided upon an investment which has already exceeded $1,000,000.

The installation of the automatic system was under the general supervision of E. L. Cline, general manager, assisted by H. W. Munsell, superintendent of equipment, and P. H. Davenport had direct charge of

the installation work for the manufacturing company. H. M. Friendly, widely known telephone engineer, acted as assistant to President Fortune during the period of automatic installation.

For the cut-over E. R. Neir, chief of Automatic Electric Company's installation department, went to Indianapolis from Chicago and took charge of the final step in this engineering feat. True to his past record, Mr. Neir finished the work with great credit to himself and to the company which manufactures the automatic telephone.

The cut-over attracted many well known telephone men to Indianapolis, among them being A. L. Stadermann, engineer of the Citizens' Telephone Company of Terre Haute, Ind., and R. R. Stevens, commercial superintendent of the Ohio State Telephone Company. F. R. Quayle, engineer in charge, J. E. Gonseth, power engineer, Charles M. Candy, patent expert, A. F. Bennett, assistant superintendent of installation, M. B. Evans, H. P. Mahoney and James S. Mooney, operating department, George A. Shoemaker, and R. H. Burfeind, all of the Automatic Electric Company, Chicago, were also present.

## Wire Lines Organize to Help U. S.

The greatest single step in national military preparedness was announced by the War Department, following the appointment to the signal officers' reserve corps of five of the leading electrical engineers of the world.

The telephone, telegraph and electrical companies of the country, it is stated, have not only given their chief executives to the nation, but have organized, equipped and officered their men to become reserves in the signal corps.

Following the appointment to the reserve corps some weeks ago of J. J. Carty, chief engineer of the American Telegraph & Telephone Company, commissions for the rank of major have been issued to George M. Yorke, vice-president, in charge of plant and engineering, Western Union Telegraph Company; Charles P. Bruch, vice-president and assistant general manager, Postal Telegraph Company; F. B. Jewett, chief engineer, Western Electric Company; F. A. Stevenson, general superintendent of plant, American Telegraph & Telephone Company.

The American Telegraph & Telephone Company has advised the War Department that two reserve companies in each of its four districts in the United States have been organized and are now undergoing training to prepare them to be turned over to the government on the first call to the colors. The Western Electric Company, which manufactures most of the supplies for the signal corps, is also forming similar organizations.

The Bell system of telephones has recently completed tests and is now prepared to connect the War Department in Washington with all the military centers in the nation in a few seconds' time. Sections on each long-distance switchboard have been designated as emergency War Department sections and are always held in reserve. Consequently when an operator receives a flash on this section all other business is halted while connections are being made.

Arrangements have also been perfected whereby the wireless and cables can be placed in almost instant communication with all overseas garrisons.

## Connection Law in Ohio

Although the measure is of doubtful validity, the Ohio senate March 2 passed the Apple bill, compelling all telephone companies to give long-distance connection with every other company. Taken in connection with the amended Gilmore bill, passed March 1, which exempts mutual telephone companies from all regulation, the measure is one of the most drastic yet acted upon. The bill slipped through almost without debate. When attention was directed to the fact that it may destroy telephone regulation, Senator Thomas A. Berry, who based a short argument for the bill on the statement that he cannot reach by telephone a friend of his in Defiance county, said: "Well, if it destroys the public utilities commission regulation, so much the better." If enacted into law the Apple bill will be tested by the large telephone companies, who will be compelled to throw open their property to rivals.

Considerable interest in Hamilton, Ohio, attaches to the Apple bill, which if it becomes a law, it is held will permit the Hamilton Home Telephone Company to get service into Cincinnati over the lines of the Cincinnati and Suburban Bell Telephone Company. There is no doubt that the Bell company will make a determined fight against the operation of the law.

## Supply of Magnet Wire Small

The 1916 production of magnet wire has greatly surpassed that of any previous year. Motor production and generator production have both been tremendous, and naturally the quantity of dynamo-electric machinery in use has considerably increased. Because of the large number of pieces of electric machinery in use, and also because so many second-hand motors and generators once taken out of service have again been put to use, repairs have been much larger than usual, says *Electrical World.*

It has been impossible to thoroughly supply this demand for magnet wire, and consequently local stocks for repair purposes are very small and in many instances have dwindled to nothing. So serious has this become that some central stations, being alarmed, have sent notices to power customers urging that the highest degree of care be taken with motors, as it will practically be impossible to effect repairs without considerable delay.

Inquiries resulted in statements that the situation was further aggravated by the difficulty in obtaining a sufficient supply of copper.

## To Re-Enact Ordinance in Detroit

To insure validity of the telephone ordinance, the common council is asked to re-enact the ordinance passed April 11, 1916, fixing the rates as at present and providing for optional measured service.

The metered service provides for business telephones limited to 150 calls a month at $4 a month and two cents each for calls in excess of that number, and multi-party telephones limited to 50 calls per month at $2.50 a month, the installation to be optional on the part of patrons.

The constitution gives to cities, towns and villages reasonable control over public utilities. On August 29, 1916, more than four months after the enactment of the ordinance, the city adopted a charter amendment for control over public utilities as provided in the constitution.

# Some Observations on the A. T. &. T.

*An Interpretation from the Independent Viewpoint*

BY TERRY W. ALLEN

THE United States again faces a crisis; possibly the most serious crisis that this government of ours has ever faced. Perhaps before this article can be published, a state of war will have been declared. I cannot see what other course President Wilson could have pursued than the course he has pursued in this connection. Personally, I have no desire to kill anyone, either on the wholesale or retail plan. Neither have I any desire to swell the coffers of the munition makers and concerns of that kind. I prefer peace to war under most circumstances, but in the present instance, for the stability of civilization, for the future guarantee against just such a condition as now exists, it is absolutely necessary for the United States to declare itself, and, if need be, fight side by side with other nations in the crushing of the military autocracy which threatens to jeopardize the civilization of the world for years to come.

Facing a world crisis is no easy matter, and Mr. Wilson's position is not an enviable one. We have seen a display of a lack of patriotism on the part of a number of congressmen and senators. Their failure to appreciate the grave situation is easy to understand. In any group of men gathered together, there is never a unanimous opinion. There is always a majority and a minority. It is indeed gratifying that the minority in this case was so small as to be unimportant, and should show the President emphatically that the country is practically unanimous behind him.

In a time like this, it is hard to think intelligently and conservatively upon the business problems that face the country; and it is also hard to think of our own problems without allowing the overshadowing dangers to disturb our equilibrium and cause irrational thoughts to prevail when rational ones are absolutely essential.

The annual report of the Bell Telephone Company for 1916 is out. It looks as though we are going to be able to add a new epigram to the old adage that "only death and taxes are sure." We believe that the new adage can be written that only death, taxes and the Bell Telephone Company's annual report are unavoidable. This report is remarkable for one thing, and that is the fact that the Bell Company seems to be getting doubtful of its position upon a number of matters. In this 1916 report, the company asks four questions as to its policy. Evidently it intends that these questions should be answered. It is my purpose to try and answer them.

The first question is as follows:

What is there unfair about any enterprise requiring the expenditure of large amounts of money for highly specialized machinery and equipment vital to its operation maintaining its own manufacture?

Of course, the way this is written in the A. T. & T. report, it does not state the other side of the case. It does not state the unfairness of the Western Electric Company's competitive position. It only gives the bright side of the Western Electric Company actions. It does not tell how the Bell Company's manufacturing appendage can go out and sell products to Independent operators while Independent manufacturers are denied the right to sell the Bell Telephone Company any apparatus, even at the present time, when it is almost impossible to get materials to carry on the work. This matter is being investigated by the Federal Trade Commission, but there is no intimation of that investigation in the Bell report. We notice also, with a good deal of regret, that Section 10 of the Clayton Anti-Trust Act has again been postponed by Congress until January 1, 1918, for this would have hit this very proposition and would have caused additional pressure against unfair competition.

The second question that this remarkable report asks is:

Why should not the ideas and suggestions originating within the system be worked out within the system itself?

We would like to answer this question with one of Edgar Lee Masters' poems on "Spoon River Anthology" which reads as follows:

My parents thought that I would be
As great as Edison or greater:
For as a boy I made balloons
And wondrous kites and toys with clocks
And little engines with tracks to run on
And telephones of cans and thread.
I played the cornet and painted pictures.
Modeled in clay and took the part
Of the villain in the "Octoroon."
But then at twenty-one I married
And had to live, and so, to live
I learned the trade of making watches
And kept the Jewelry Stores on the square,
Thinking, thinking, thinking, thinking,
Not of business, but of the engine
I studied the calculus to build.
And all Spoon River watched and waited
To see it work, but it never worked.
And a few kind souls believed my genius
Was somehow hampered by the store.
It wasn't true. The truth was this:
I didn't have the brains.

Possibly the irony of this statement will not be appreciated, but it is known to the telephone world that the majority of the advances in the telephone art have been made by the Independent manufacturers, who are free from the chains that throttle those who work under the domination of a monopoly.

The third question that is asked by the American Telephone and Telegraph Company is a long one and hard to understand, a question that is very indefinite and one which I really am not able to explain. It reads as follows:

If there is a public demand for competition in the telephone service or for opposition exchange, there is nothing to prevent the building, but if opposition companies are built in the particularly "fat" districts of the Bell System, is there any reason why the deficiencies of the limited service of such opposition should be supported by the Bell System from the facilities it constructed for and needs for its own service, or is there any reason why the Bell System should raise capital to build additional facilities not needed for its own service, often unprofitable, to supply such deficiencies?

Mr. Vail is asking about competition and about the public demand for competition. He asks, if the competing companies build in particularly fat districts of the Bell System, why their lines should be given to the independent companies that do build in these fat districts, and why the Bell Company should spend money for the benefit of others.

Really, I do not understand why the Bell Company claims to be such a magnanimous corporation, if it does

not intend to work out the policy it has been advertising for the past forty years—namely, the monopoly idea. It wants to be a monopoly. It wants to give all the telephone service and it has never really thought that competition had any rights. But now, it displays a curious idea about competition. It asks its stockholders about competition. I am at least glad to think that the A. T. & T. Co. has a doubt in its mind as to the rights of competition. Heretofore, there have been no question marks in connection with the statements of this kind. Evidently, the education accorded the A. T. & T. Co. through the Independent telephone journals during the past two years is bearing fruit. It has caused this giant to put a question mark after a matter containing something about competition. It should at least give the Independent telephone companies some small hope that the Bell Company is not so all-powerful sure of its ground as it was. I take this as a good sign. When a man asks a question there is hope for him—and government ownership is more to be feared than competition.

The fourth question they answer themselves. But I answer it in my own way in order not to be guilty of an indiscretion of that kind. It asks:

> What made it possible for the same instruments to do at one time, the impossible at the other?

My answer is that Independent telephony made it possible because it forced the Bell Company to improve its system; to take up new ideas, to substitute good for bad or lose its standing with the public generally.

Possibly the Bell Company will take exception to my interpretation of these questions. This would not surprise me. Nevertheless, these four questions are interesting. They show a lack of the old time spirit of divine right of the Bell Telephone Company to do as it saw fit in any way in order to achieve its cherished hope, monopoly.

There are other inconsistencies in this report besides these questions. Mr. Vail makes a statement in one place that there are eleven million, three hundred thousand telephones in the United States. Six million, five hundred thousand are Bell owned and four million, eight hundred thousand are owned by Independent companies or associations. Then in the next paragraph, Mr. Vail states that ten million of these stations are Bell stations or connected with the Bell Company. This would leave only one million three hundred thousand Independent telephones in the United States. Certainly we are in a pitiful condition—the simon pure Independent telephone companies. Certainly we have no right to jeopardize our three million three hundred thousand Independent stations that connect with the Bell System just because one million three hundred thousand of us do not want to get into the Bell family.

In another place Mr. Vail says, speaking of rural telephone lines in the country:

> There are tens of thousands of such plants now in operation, independent of the Bell System, connected with it and giving a local or limited service.

All of the Independent telephones in the country must belong to this horde of tens of thousands of Independent rural companies. There is certainly something inconsistent about these two statements. If the majority of the Independent plants are rural companies, then it would be very easy to see that the Bell Company considers our fight against its monopolistic tendencies a small and insignificant matter. I do not believe this condition exists. I believe that there are over five million telephone stations in the United States that are not connected with the Bell System.

I would advise every Independent telephone operator to get this 1916 Bell report and study it. I shall not attempt to give any interpretation of the financial situation presented. It would take too much time and space. But I did want to call attention to the questions that the Bell Company asks; because, in asking these questions, it shows that Independent telephony has a better chance than ever before.

## No Equipment in Oklahoma

Tulsa, Oklahoma, has more than nine thousand five hundred telephones, and the inability of the Pioneer Telephone & Telegraph Company to secure additional equipment keeps the local company from adding several hundred telephones for which application has been made.

Manager C. F. Bell of the Pioneer company declared that he had almost decided not to accept any additional applications for residence telephones and that business telephones were in such demand that many firms were forced to use one line, when business demanded several extensions.

"We find it impossible to secure equipment with which to make these extensions and for the installation of additional telephones for residences," said Manager Bell.

"In the past we have found that at the end of each month we could count on securing as many as twenty telephones from subscribers who failed to pay their rental within the prescribed time limit. Now we feel lucky if we get five such telephones. The people realize that if they have their telephone taken out it may be months before they can secure another."

While Mr. Bell was recounting what the war prices on copper and other metals had done to the telephone business at least a dozen applicants for telephones were pleading with the contract clerks for first chance at the next telephone.

An insurance man, with a down-town office, asked for an extension in his place of business. He was told that there was no equipment for placing the extension in his private office.

"I've got an extension in my residence," he told the clerk. "I guess I'll have it taken out and placed in my private office. I must have an extension even if I have to rob my own home to get it."

"It's the demand made for copper, brass and other materials used in telephones by the war munitions factories," Mr. Bell declared, "that has caused the scarcity of equipment for telephones. And the growth of Tulsa makes the want felt most keenly here."

## Move to Abolish Moving Day

Quite a stir has been created in renting circles as well as among renters and other interests concerned by the revival of a campaign for the abolition of "moving day" in Chicago.

It is said that "moving day" costs the Chicago Telephone Company approximately $50,000 to make the necessary changes in service.

## Decatur Merger Completed

In a deal completed in Chicago March 8 the Bell Telephone Company purchased the Decatur Home Telephone Company of Decatur, Ill. The consideration was said to be $327,000. The Bell company will erect a new plant in Decatur and merge the two lines.

# Interference of High Tension Circuits

*Read Before the Convention of the Minnesota Independent Telephone Association*

BY O. A. KNELL*

IN arranging a paper on this subject, I have tried to use as few technical terms as possible. The lines are already in operation, and the power people will not change machines for those of an approved design, unless legislation is enacted that will make them liable for all expense of eliminating trouble, and then only if the change of generating units costs less than the rebuilding of the telephone lines.

We will assume that we are working with the present design of standard 60 cycle A. C. generator. These are mostly made to deliver current at 2,300 volts, and if the transmission line is a higher voltage it is stepped up by transformers. The standard practice is to deliver current in three-phase delta connection, which is the least liable to cause induction on telephone lines.

### CAUSES FOR DISTURBANCE

There are three causes for disturbance on telephone circuits, due to electric light currents, if the apparatus of both companies is of standard type and lines properly constructed: First, direct leak from one line to another; second, the grounding of the telephone or electric light lines, and third, an unbalanced condition of the lines.

Taking the first case, direct leakage may be due to both lines being in the branches of the same trees, or it may be due, especially on joint construction, to the breaking down of insulators, or the insulators being coated with soot, as at railroad crossings, or near factories, where there is a great deal of smoke. The latter case is one which would not often occur, but tree leaks are not uncommon and in many cases most annoying as when the lines are built and properly transposed to kill the noise they may be nearly, or commercially, quiet, but the trees grow around them, and the noise increases very slowly, so that employes of the company, whose duty it is to check the line conditions daily, do not notice it, and the loss of business is the first intimation that a serious condition exists.

The second cause is one that can usually be found by tests, either by the telephone or power company, or both. With the higher voltages on transmission lines, that is, over 13,000 volts, there is very little liability of grounds, except at escapes at insulators, as heavy grounds show up at the power plant. On the ordinary primary circuit, within the limits of a town, or city, there is a greater liability of the electric light circuits becoming grounded and no attention being paid to it by the central station operators.

The last cause may be due to (1) the light current being split up as in a series street light circuit, (2) the telephone circuit being out of balance as in a common return system, or when one of the wires of a metallic circuit is larger size and consequently of a lower resistance, or some foreign wire connected to one side of a metallic line, or (3) improper transpositions.

The series street light circuit, under normal conditions, and if of a lower voltage, is one of the hardest conditions to contend with, and I would advise keeping as far as possible from this type of feed wire. A case in point happened this summer, where a phantom circuit was noisy at night, as soon as the street lights were lit. It was found that two conditions caused the trouble. The arc circuit was the same height from the ground, and only three feet away from the telephone circuit. Also the power wire had a ground on the circuit, somewhere on the loop, which paralleled the telephone circuit. In the first place, the ground was cleared up, which eliminated part of the trouble, and the arc wire was brought directly below the telephone circuit, and proper transpositions cut in. This eliminated the noise on the telephone line.

In most cases transpositions will kill all noise if properly placed and the circuits are otherwise clear.

### STUDY INDIVIDUAL CASES

Each individual case must be studied aand dealt with separately. If the circuits are exactly parallel, as they would be in joint construction, and break away from each other at right angles, the problem would be the simplest. It is necessary to cut in transpositions so that each wire of the line will be the same parallel distance from the nearest light wire, and have the same number of running feet; that is, if the lines are parallel for a thousand feet, cutting in the transpositions at the middle joint will cut down the noise. If more transpositions are needed to eliminate it entirely, another should be cut in the middle of the joint of each section; that is, three transpositions would be cut in two hundred fifty feet apart. This does not always hold true, as there may be a transformer or leg connected to the lighting circuit some place in the one thousand feet; if so, it would be considered two exposures, from one end to the transformer is one exposure, and from the transformer to the other end would be the other exposure, each to be treated the same as before.

About the hardest condition to handle is where the lines are not parallel, but nearly so: For instance, when one would be on the highway, and the other follow a railroad right-of-way, which diverges at a slight angle, so that at one end there may be ten or fifteen feet between and at a place one-half mile away be three or four hundred feet apart. (Litchfield case; Red Wing case.)

Another condition which necessitates considerable study is where the cause of the trouble is not at the point where are lines parallel. The telephone circuit may be properly transposed at this point to take care of induction, but a grounded telephone circuit on the same poles with a metallic telephone line, a number of miles away, may be the cause of the noise. This is due to the same effect as if the condensors were connectel to one wire of the metallic and ground; for this reason toll companies are loath to allow any grounded circuits on their heavy trunk leads.

Except for the liability of damage due to the breaking of the top wires, with joint construction, it is generally easier to eliminate inductive disturbances where both lines are on the same pole, than where they are some distance away on a separate lead of poles. This is due to the different sags in the circuit.

### CO-OPERATION DESIRABLE

One feature that I wish to bring up is co-operation among the companies. When the transmission companies start to build high tension lines they should make the necessary surveys with regard to telephone lines and enter into proper arrangements to take care of interference, by moving or other construction. As it is now, the power companies start building, setting poles, and if the

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telephone companies are not alert to discover their intentions, the current is turned on.

I believe that where a telephone company is peacefully enjoying a certain position on a public highway, and another private corporation constructs a line so as to render the first property less efficient, the last should stand all the expense to eliminate the trouble. It will mean additional expense for the telephone company for all time, due to the extra transpositions which would have to be cut in, these being more liable to put the line out of service, if transposition glass is broken; also the liability of the line being grounded, or any other trouble, and even with the best construction the lines will break down.

RIGHTS OF TELEPHONE COMPANIES

As to the legal rights of the telephone companies, different states have adopted different methods, some of them by direct legislation, and others by rulings of commissions. The Iowa Commission handed down a decision lately. There has been no real decision by the Minnesota Commission so far as I know, up to this time. As a matter of fact, I have personally not found it necessary to resort to any legal action, in order to adjust matters between the transmission companies and the telephone companies. I am confident that the get-together spirit is the right thing. The power companies recognize the rights of the telephone companies, and if the conditions are put up to them, I have found them generally willing to make any change, and adopt any measure which will give permanent relief. It is not to be expected that power companies can be persuaded to build new lines where the old ones are unfit for service. They do, however, generally concede the fact that grounded circuits must be made metallic and are willing to help on changes of this kind, or make them entirely at their expense.

The legal phases of the question were very broadly brought up and discussed by Mr. Byers of Grinnell, Ia., at a paper which he gave at the National Convention in Chicago, last December.

Another feature which must be borne in mind is that the central office equipment must all be built and operated in a way to take care of inductive disturbances. For instance, a metallic line may be built, transposed and maintained in such a manner that there is no interference whatever, but when this line is connected to another line through a switchboard, a resulting circuit may become so noisy as to interfere with conversation. Repeating coils of proper design in the cord circuits of the switchboard would entirely clear the lines of the noise. Nearly all the engineers, at present, are recognizing this condition and manufacturing equipment to handle this situation, but it depends upon the operator to make the best use of the apparatus after it has been furnished.

The method which is used by some of the larger companies to make a study of conditions is to send a man out and have him go over the locality very carefully, making up complete field notes, covering all conditions which might cause interference, and submit them for study.

## Joplin Zone System Protested

An investigation of the service of the Joplin, Mo., Home Telephone Company several weeks ago by J. F. Lee, commissioner of public utilities, resulted at a meeting of the city commission in an attack on the rates of the company.

The company has described a circle around its office near Fourth and Joplin streets with a radius of one mile. All subscribers outside of the circle are required to pay, in addition to the regular rate, 35 cents for each additional one-fourth mile they are removed from the office.

The domestic rate within the circle is $2 a month and the commercial rate $3.50.

In the opinion of the city commission, the additional charge is discriminatory and the matter may be taken before the Missouri public service commission, which granted the company permission to charge it, in an effort to have it revoked and rates made horizontal throughout the city.

Mayor Hugh McIndoe presented the matter to the commission and urged that an investigation be made. The council appointed the mayor and Lee as a committee to prosecute action toward having the rate revised. .

## Supplies Scarce in Illinois

The Vermilion County (Ill.) Telephone Company has some new switchboards and other supplies ordered, but cannot get them. The company has been notified by the Western Electric Company that these supplies cannot be delivered now and that if the company can get them elsewhere the Western Electric will be pleased to release it from the present contract. However, the plant is wholly a Western Electric plant and the new unit, it thinks, must come from that company.

In letters being sent out to patrons of the concern regret is expressed that many present contracts cannot be filled; that one-half the enormous plant at Hawthorne, Ill., has been turned over to the United States government and that, if the federal government desires it, the remainder of the plant will be given over to the service of the government.

War munitions are being manufactured at the Western Electric Company's plant, munitions being badly needed in the event of a conflict with a foreign nation, but the details of which are not being made public and the work on which is being done in as secret a manner as possible, it is stated. Only a part of the supplies are being turned out at the Chicago plant, other parts being made elsewhere and assembled in the government arsenals. Wire for use in the field telegraph and a number of motors and other things needed by the army and navy in the event of war are also being turned out by the company, it is understood, though no official information is being given as to what is being done at the Hawthorne plant.

## Ohio Association for Politics

Representatives of nearly three hundred small Independent telephone companies in Ohio, meeting in Columbus, March 7, formed the Ohio Co-operative Association of Telephone Companies, the announced purpose of which is to take a more active part in political affairs of the state and particularly with reference to legislation affecting their interests.

The members declared they were being discriminated against in favor of the large telephone interests of the state.

J. T. Christy, Monroe county, was elected president, and C. E. Hermetet, Sidney, was elected secretary and treasurer.

The association went on record in favor of the Apple bill in the senate to require long distance lines to furnish connection with local telephone exchanges.

# European Telephone Development

*Translations from the Foreign Press and Communications from European Engineers*

BY FRED W. SCHOLZ

THE installation and equipment of a telephone system, especially an interurban or, as we call it, long distance telephone system, represents a considerable capital, which must be made to produce profits by every available means. Since the returns depend on the number of calls made, it is necessary to fix the methods that can be used to increase the returns from the telephone circuits.

As a basis we might propose the following principle: Give to each operator only a small number of telephone circuits to serve. This number should be determined only by the average time it takes an operator to make a connection. One can easily understand that two or three conversations can end at the same time, and that, in this case, the operator would have to look first after one circuit, then after the second, etc. In this way there would be some time lost, however, for the second and third circuits. In reality there exists no absolute rule which determines how many lines to entrust to one operator, but we can deduce an average practice which allows us some conclusions from experience.

Let us consider the telephone connections between the cities of Paris and Lille, a distance of about 150 miles. Before the war, when Lille was a flourishing manufacturing city, it was connected with Paris by eleven telephone circuits. To determine the number of operators needed for these lines, we can proceed in the following manner: For a day or two one single circuit is entrusted to one operator and the average number of calls usually sent on this circuit during the hours of heaviest traffic is increased. The following day a second circuit line is added and, if the average hourly calls of communications over the circuits remains the same, a third line. If with this new third line the number of communications on the circuit, previously determined, decreases, it is admitted that the operator cannot serve more than two lines satisfactorily. In support of the above statements the experience with the Paris-Lille telephone line might be quoted. The six lines between these two cities were connected to the central Paris exchange over two switchboards, which held one circuit from Dunkerque and two circuits from Douai in addition to the Lille circuits. At the Paris exchange one operator took care of five circuits, the other operator of four circuits. The average daily number of communications between Lille and Paris was 535 units. The distribution of the circuits was made at Paris and at Lille over three switchboards, two circuits per switchboard, to the exclusion of other lines. During the same week the average of daily calls exchanged between Lille and Paris under the new system increased from 535 to 775, equivalent to an increase of 40 units of conversation per circuit and an increase of daily receipts of: 15x(775-535)=$21.00.

The new distribution of circuits has had as one effect the increase of the operating staff to eight, four for the Paris exchange and four for the Lille exchange. But the increase of calls was enough to pay the additional expenses three to four times over again. The measure adopted by the authorities has shown very clearly the truth of an economic phenomenon, which might be stated as follows: Communications being attended to by operators with an increased amount of attention and being put into a shape which makes them more certain and assures satisfactory service, the direct result is a greater demand for connections and a resulting increase in daily calls during a certain period of time.

The same experiments were made later at Rouen and at Havre, the results being the same in both cases. More recently the doubling of the switchboard equipment for the Paris-Brussels (ante-bellum) lines gave a daily increase of 30 units of conversation, which amounts to an increase of $18.00 per day, needing an increase of only four operators, two for each of the two terminal points of the line. In general it might be stated that the increase of the switchboards by 11 new ones led to an increase of about 500 conversations per day, the number of circuits employed remaining the same. Similar observations were also made when putting in commission other interurban switchboards, whose terminal points were not as far distant as the ones mentioned.

The total records of March, 1913, gave a gross increase of telephone traffic of 150,000 units of conversation, when comparing the record to the same month in the previous year. A unit of conversation represents a complete conversation from the time the number is called for, to the time when connections are again cut off. The following table gives an indication of the telephone service from January 1, 1912, to July 31, 1914, the day before the war broke out. It is seen from that record, that the average daily returns of a circuit changed from 75 units of conversations in July, 1912, to 90 units, July, 1914.

TABLE 1. EXPLOITATION OF INTERURBAN TELEPHONE LINES

| | 1912 | | | 1913 | | | 1914 | | |
|---|---|---|---|---|---|---|---|---|---|
| Month | No. of circuits | Average No. of conversations per day | Total No. of conversations per month | No. of circuits | Average No. of conversations per day | Total No. of conversations per month | No. of circuits | Average No. of conversations per day | Total No. of conversations per month |
| Jan. | 471 | 28,850 | 806,181 | 509 | 32,700 | 890,728 | 561 | 41,500 | 1,141,999 |
| Feb. | 472 | 30,386 | 786,274 | 507 | 34,250 | 842,393 | 563 | 43,856 | 1,105,869 |
| Mar. | 474 | 32,012 | 870,930 | 517 | 38,235 | 1,025,533 | 570 | 44,355 | 1,255,128 |
| Apr. | 475 | 34,600 | 915,238 | 524 | 38,827 | 1,054,352 | 575 | 48,922 | 1,297,380 |
| May | 473 | 35,250 | 948,709 | 530 | 41,770 | 1,119,758 | 578 | 50,300 | 1,352,923 |
| June | 476 | 36,150 | 959,041 | 537 | 42,900 | 1,137,189 | 580 | 51,240 | 1,363,852 |
| July | 482 | 36,000 | 984,415 | 540 | 43,800 | 1,199,279 | 589 | 52,900 | 1,456,077 |
| Aug. | 485 | 32,960 | 899,301 | 542 | 38,665 | 1,078,198 | State of War. | | |
| Sept. | 492 | 35,550 | 935,963 | 545 | 42,958 | 1,164,768 | State of War. | | |
| Oct. | 497 | 35,270 | 995,270 | 554 | 44,120 | 1,244,274 | State of War. | | |
| Nov. | 500 | 33,700 | 894,648 | 554 | 42,165 | 1,091,035 | State of War. | | |
| Dec. | 503 | 33,336 | 855,657 | 558 | 41,450 | 1,141,783 | State of War. | | |
| Total | ... | ..... | 10,851,627 | ... | ..... | 12,989,290 | ... | ..... | 8,943,228 |

AVERAGE RETURNS OF CIRCUITS PER DAY

| | 1912 | 1913 | 1914 | | 1912 | 1913 | 1914 |
|---|---|---|---|---|---|---|---|
| Jan. | 61 | 65 | 74 | July | 75 | 81 | 90 |
| Feb. | 64 | 67 | 78 | Aug. | 68 | 71 | War. |
| Mar. | 67 | 74 | 78 | Sept. | 72 | 79 | War. |
| Apr. | 73 | 74 | 85 | Oct. | 71 | 80 | War. |
| May | 74 | 79 | 87 | Nov. | 67 | 77 | War. |
| June | 76 | 80 | 88 | Dec. | 66 | 74 | War. |

One would find an even greater increase if the record had been applied to long distance calls only, leaving out suburban calls. As a matter of fact it is just the call with a high toll rate, which was in view when making the statement of principle, found in the introductory remarks. The industrial exploitation of telephone lines would require a return of 20 units of conversations of three min-

utes' duration each during one hour, if the enormous capital that is sunk in the telephone equipment is to bear an adequate return. Can this theoretical standard be obtained in actual practice? There are certain losses of time that are hard to eliminate, but it seems possible to approach the ideal limit by giving only one or two long distance or interurban circuits to each operator and in turning over to the telegraph such work as is needed for the preparation of the call and necessary communication between telephone operators.

The method of exploitation giving the ideal results is simply this: The same operator is at the same time telephone and telegraph operator. During the course of a telephonic communication the corresponding operator calls for the proper line by the use of the Morse telegraph; the call is received in a relay, which lights up a lamp, whose purpose is to attract the attention of the operator. All the latter need do is to press down a special key in order to receive in her telephone receiver the telegraph click. One can not only start this present call, but also prepare the next one, so that the subscribers can immediately proceed to call, as soon as the line is ready for the new call.

It will be easier to understand the advantage of this method after discussing one of the causes which takes time and produces losses in utilizing the circuits. Suppose a communication is established on the line Paris-Nizza. The operator at Paris, during the time when the two subscribers are talking over the wires, is preparing the following call. The operator calls the subscriber at once, in order to inform him that he is about to be called to his telephone for the desired call. The operator at Nizza does the same, the Paris subscribers' wire being meanwhile closed to other calls. But it may happen that one or the other of the two parties is busy. In this case the operator can advise the operator at the other end of the line to call that subscriber only after he is through with his first call. Meanwhile the Paris-Nizza circuit remains idle, while waiting for the open wire.

Under the proposed system, when one or the other operator finds out that her subscriber is busy, she advises her colleague in the other city by Morse telegraph and then proceeds to prepare the following call. A code of abbreviations is used to reduce the signals down to the least trouble. The drawback to this scheme lies in the fact that it is hard to find operators who can be telephone operators and at the same time pay attention to the Morse signals. But there is no question that enough operators can be found who are sufficiently bright to be trained to do this kind of work.

If this method should not be favored there is a second one, that of "undivided or continuous attention," which would also give as good results from the point of view of service on the lines. Although applied in England, it has an objection in France, in that it violates the rule that operators must not listen to conversations. This rule would have to be modified. In this system the operators keep up their listening key and keep in constant attention on the call before using the circuit for another conversation. This system of continuous attention allows the omission of closing signals when the conversation is finished, and also the suppression of the work of testing for busy wire by the operators, if the following points are taken in consideration:

First of all, a large number of calls do not take the entire three minutes allowed for a unit call; the closing signals are here given by the subscribers. But this closing signal may be delayed and the operator will not immediately disconnect and open the line for more business, since she has no closing signal from the other operator to show the end of the call. Second, the intensity of the call current varies with the state of the line, the reception of the calls is at times faulty and the call relay has to be readjusted. Moreover it has been noticed that operators often do not respond at once to the closing signal given by the subscriber and have a tendency to keep on what they are doing at the time, perhaps writing down a call, before disconnecting. All this loses valuable time and is avoided by the continuous call system, where the operator is likely to react at once, as soon as the two subscribers stop talking.

We will end this discussion by examining the possibility of increased service on the part of operators by giving them a bonus or a premium. Different reports of the French department have taken up this question and its solution. February, 1912, the department first made a serious study of the situation. It tried to find out the conditions under which these premiums were to be handed out, the amounts to be offered and whether to give them for both city and long distance calls. The final report may be summed up as follows: the basis for the bonus must be simple to control, free from chance of fraud and likely to keep the operators in a frame of mind of willingness to work hard for them. It must also show financial results which justify the introduction of such a system. An examination of conditions in exchanges taking care of local calls only, showed the inadvisability of such a system. It seemed however advisable for interurban calls. Finally the following scheme was adopted for trial:

The bonus system is to be applied only during the hours of heaviest traffic. The minimum number of calls per hour, from which the premium starts out, is fixed for each individual circuit or rather for each set of circuits between Paris and the corresponding exchange in the other city. A very careful time study had been made of all the circuits in question. All the incidents that bring with them losses of time have been noted. Although their nature varies greatly, they can be divided into two large classes: Those which can be avoided and those which cannot be avoided and are therefore independent of the operators at the two terminal ends of the circuits.

Under the first head come such losses as ringing of a subscriber's bell an uncommonly long time or having the subscriber let the operator wait too long before answering her call. It is clear that such losses could be avoided by having the operator prepare her call before finally making the definite connection. The trouble under the second class, such as poor connections due to faulty wire and consequent longer time used for conversation, are not within the reach of the operator and not her fault. The troubles under the first head were therefore considered in making up the calls to be served by the operator before beginning her premium calls, and the number of calls was fixed on the basis, that she will have to avoid such losses by all means.

It may be said in general that the premium is not supposed to add heavier burdens to the operators, but only to recompense them for professional cleverness and speed and spur them on to better work. During the course of the month of July, 1914, the department made it known that a fund of $1,000 had been appropriated for a trial of premiums to be applied to the long distance circuits in the principal cities of France. The payment of premiums and observations were to begin with the first of September. Unfortunately the war broke out

and all telephonic communication between cities was stopped with the 2nd of August. It is hoped, however, that the near future will allow this work to be resumed again and may point a way to more efficient and profitable work.—*Annales des Telegraphes et Telephones.*

### AUTOMATIC TELEPHONY IN ITALY.

An important report treating the introduction of automatic telephones in Rome was recently published by the Telephone and Telegraph Department of the Italian administration. This report reviews the exploitation of the new system, since its introduction November, 1913, in one of the Rome exchanges holding about 2,000 subscribers; one-third of this number is supplied with semi-automatic service. The operation of this part of the exchange is characterized as follows:

"The technical results have been very satisfactory; the public has found no difficulty in adapting itself to the new system; moreover it has clearly expressed its preference for the full automatic as against the semi-automatic system. The number of interruptions through engineering difficulties and repairs has been surprisingly small, much less so than the repairs needed in the manual system." Of course it should be noted here that the manual system in Rome is antiquated, and that the more favorable report for automatic system from this viewpoint must be accounted for partly by the fact that the latter is of latest design and has not yet suffered the wear and tear that fell to the lot of the manual system. The nature of the repairs in the automatic system was such that no interruption of service took place. The telephone sets of the subscribers and the exchange equipment proved more durable and less delicate than had at first been believed possible.

Regarding expenditures the committee reports: "The committee examined the financial results with a viewpoint to profits of the automatic exchange (Prati) and the manual exchange (Crociferi). It was difficult to estimate the actual expenses and returns of the two systems under identical conditions, but the conclusions finally were that the returns from the automatic system were more favorable than those from the manual system."

The committe then went on to investigate the two systems, one being of a modern common battery manual service, the other the automatic service, which of course showed up in favor of the latter. Finally the influence of the introduction of the new scale of tolls, charging for the amount of time consumed at the telephone was investigated. The question was whether this new toll rate would lower the number of conversations on the manual system in favor of the automatic system, or vice versa. This study showed that the automatic system begins to lose its advantage over the manual system, if the conversations drop down to six or seven conversations per day per circuit. In Rome, however, where the telephone system is not so densely spread as in other larger cities of the Continent, this is not likely to occur. The greater opportunity of decentralizing the telephone system by the automatic telephone was also mentioned in the report.

These studies are of great importance for the reorganization of the telephone system of Rome. The introduction at this city of an automatic telephone system means a distinct advantage in technical and economic lines. There had been an appropriation of $1,870,000 to expand the telephone system at Rome and nearby cities, installing manual service. Had this been done, it would have been impossible to install the automatic system, as the administration would have refused to scrap an equipment that had just been installed at such a great expense. As it is, money is ready for the automatic system.

The tendency to replace manual by automatic system has been accentuated lately in many of the European countries, such as Germany, Austria, Switzerland, England, Holland, Sweden, France, etc., where systems on a small scale have been in use for some time. In America this system is used in large cities with great satisfaction.

The objections against the automatic system were of diverse kinds and importance; one reason advanced stated that the subscribers would not look upon the change with favor and would find trouble with the use of the automatic dial which would give rise to many errors. The committee by means of a questionnaire found out that at the Pratt automatic exchange in Rome 94.9 per cent of the subscribers were satisfied with the antomatic and automanual system, 5.1 per cent were not satisfied, and 13 per cent complained of the service of communication with the manual exchange of Crociferi. This last is probably due to the old manual equipment at that exchange, which comprises a vertical Western switchboard for 6,500 subscribers and a horizontal Siemens switchboard for 3,500 subscribers. The use of the automatic dial gave cause for errors during the first few months of service of 1.18 per cent, which latter dropped down to 0.37 per cent and is rapidly decreasing The percentage of disorders at the automatic system, none of them very serious, ranged from 27 to 53 per cent, which is less than that found in the manual system.

Concerning the expense of installation of the automatic system, the report states that the decentralization of equipment made possible more than offsets the higher expense for the exchange installations and subscribers' sets. For depreciation the committee allowed 4.4 to 6.7 per cent of the installation costs. If the average number of conversations per line is taken at 10, the saving effected is from 21.5 to 11.6 per cent over the manual system; at 7 conversations per line the saving is somewhat less and the advantage disappears entirely at 5 conversations or less. The annual expenses per subscriber even favor the Rome automatic exchange over the similar systems in other countries, keeping in mind that the Rome system has about 13,000 subscribers. The expenses for the other countries per subscriber are as follows:

| | | |
|---|---|---|
| Germany | $6.62 | per subscriber |
| Austria | 3.68 | " " |
| United States | 7.22 | " " |
| France | 4.92 | " " |
| Italy | 5.62 | " " |

—*Annales des Telephones and Elettricista.*

### TELEPHONE DEVELOPMENT IN JAPAN.

Since the opening of the telephone service in Japan in the cities of Tokio and Yokahama, December, 1890, the progress of the telephone has been so remarkable that within 25 years the number of subscribers has grown to 210,000 and the mileage of telephone lines has increased to 500,000 miles.

From the financial standpoint these 25 years can be divided into five periods as follows:

| | | | |
|---|---|---|---|
| Preliminary period | 1890-1895 | appropriated $ | 273,744 |
| First expansion period | 1896-1903 | | 6,383,416 |
| Military and temporary | 1904-1906 | | 1,358,816 |
| Second expansion period | 1907-1912 | | 13,181,390 |
| Further extension | 1913-1915 | | 4,378,382 |
| Totals | | | $25,575,748 |

The telephone was introduced in Japan November, 1877, i. e. in the course of the year following the cele-

brated invention of Alexander Graham Bell. But at this time it was used only for very particular occasions, even after the adoption of the carbon microphone. However, the usefulness of the telephone was more and more appreciated by the authorities.

In the year 1888 a special copper telephone line with transposed wires was established between Tokio and Atami (66 miles) and January, 1889, the first practical telephone service was taken up between the two cities. During May of the same year the line was extended to Shizouka, a distance of 115 miles from Tokio. A second test over this line showed the practical use for the telephone for business, and from that time dates the gradual extension of the telephone in Japan.

December, 1890, the first telephone exchanges were introduced for government use at Tokio and Yokahama and since then the service has been exclusively in the hands of the government. At the beginning, when the telephone was first introduced for public service no exceptions were made in the telephone subscribers' rates. Whoever had money enough could have a telephone installed and thus become a subscriber. The number of subscribers at Tokio was only 179 and at Yokohama 45. In a short time, however, the demand by the public for telephones increased enormously, and at the end of 1895 the number of requests for service had increased to 7,000, of whom only 3,000 could be supplied with telephones.

TABLE 2. GROWTH OF TELEPHONES AND SUBSCRIBERS IN JAPAN

| Year | No. of Exchanges | No. of Subscribers | Year | No. of Exchanges | No. of Subscribers |
|---|---|---|---|---|---|
| 1890 | 2 | 343 | 1903 | 46 | 35,013 |
| 1891 | 2 | 821 | 1904 | 47 | 35,528 |
| 1892 | 4 | 1,504 | 1905 | 56 | 36,694 |
| 1893 | 4 | 2,672 | 1906 | 79 | 43,266 |
| 1894 | 4 | 2,843 | 1907 | 167 | 58,562 |
| 1895 | 4 | 2,858 | 1908 | 318 | 78,485 |
| 1896 | 6 | 3,232 | 1909 | 487 | 102,626 |
| 1897 | 8 | 5,326 | 1910 | 678 | 128,502 |
| 1898 | 13 | 8.064 | 1911 | 856 | 157,167 |
| 1899 | 20 | 11,813 | 1912 | 1,002 | 181,182 |
| 1900 | 25 | 18,668 | 1913 | 1,006 | 200,271 |
| 1901 | 25 | 24,887 | 1914 | 1,097 | 211,546 |
| 1902 | 29 | 29,941 | | | |

To meet the pressing demands of service it became important to install telephones as fast as they could be procured. The first important expansion took place from 1896 to 1903, when about 32,000 new subscribers were connected to the telephone system and the total length of interurban lines reached 7,400 miles. In spite of all this 21,000 requests for telephones had to be turned down.

TABLE 3. INCREASE OF LENGTH OF LINES

| Year | Length in Miles: Wires for City and Interurban Lines | Private Wires | Totals |
|---|---|---|---|
| 1890 | 669 | 139 | 808 |
| 1891 | 1,435 | 139 | 1,574 |
| 1892 | 2,906 | 329 | 3,235 |
| 1893 | 4,068 | 332 | 4,400 |
| 1894 | 4,307 | 329 | 4,636 |
| 1895 | 4,851 | 410 | 5,261 |
| 1896 | 6,347 | 542 | 6,889 |
| 1897 | 15,521 | 908 | 16,429 |
| 1898 | 28,240 | 3,038 | 31,278 |
| 1899 | 39,475 | 4,783 | 44,258 |
| 1900 | 57,172 | 5,310 | 62,482 |
| 1901 | 79,780 | 6,245 | 86,025 |
| 1902 | 98,941 | 6,839 | 105,780 |
| 1903 | 106,004 | 7,397 | 113,401 |
| 1904 | 110,916 | 10,452 | 121,368 |
| 1905 | 113,102 | 12,055 | 125,157 |
| 1906 | 122,817 | 14,272 | 137,091 |
| 1907 | 154,078 | 21,474 | 175,555 |
| 1908 | 181,515 | 28,615 | 210,130 |
| 1909 | 224,563 | 38,235 | 262,798 |
| 1910 | 266,263 | 46,767 | 313,030 |
| 1911 | 332,923 | 56,038 | 388,961 |
| 1912 | 394,815 | 63,461 | 458,276 |
| 1913 | 426,036 | 64,857 | 490,893 |
| 1914 | 455,753 | 71,358 | 527,111 |

As regards telephone rates and subscribers' rates a registration tax was passed in December, 1897, and to this was added a special rate for long distance calls, payment for instruments, equipment, etc. In 1906, party line systems and rates were introduced and the same year also a toll rate for conversations figured on the time limit basis.

TABLE 4. GROWTH IN TELEPHONE CONVERSATIONS IN JAPAN

| Year | No. of Conversations: Local and Interurban Calls | Calls Over Private Wires | Totals |
|---|---|---|---|
| 1890 | 256,908 | 8,080 | 264,988 |
| 1891 | 1,610,332 | 44,265 | 1,654,597 |
| 1892 | 3,117,441 | 54,499 | 3,171,940 |
| 1893 | 7,586,202 | 116,200 | 7,702,402 |
| 1894 | 13,317,490 | 180,314 | 13,497,804 |
| 1895 | 12,881,760 | 207,070 | 13,088,830 |
| 1896 | 12,016,081 | 222,326 | 12,238,407 |
| 1897 | 16,057,966 | 284,502 | 16,342,468 |
| 1898 | 27,364,935 | 341,392 | 27,706,327 |
| 1899 | 45,176,380 | 537,861 | 45,714,241 |
| 1900 | 65,844,742 | 733,227 | 66,577,969 |
| 1901 | 89,346,010 | 809,975 | 90,155,985 |
| 1902 | 117,423,373 | 924,781 | 118,348,154 |
| 1903 | 130,395,939 | 1,147,409 | 131,543,348 |
| 1904 | 143,899,359 | 1,326,645 | 145,226,004 |
| 1905 | 148,989,171 | 1,507,045 | 150,496,216 |
| 1906 | 152,767,511 | 1,898,297 | 154,665,808 |
| 1907 | 262,506,359 | 2,593,005 | 265,099,364 |
| 1908 | 320,706,712 | 3,816,340 | 324,523,052 |
| 1909 | 416,955,984 | 5,915,318 | 422,871,302 |
| 1910 | 548,999,342 | 9,152,942 | 558,152,284 |
| 1911 | 753,617,423 | 11,531,740 | 765,149,163 |
| 1912 | 841,753,240 | 14,970,339 | 856,723,579 |
| 1913 | 910,000,684 | 17,637,142 | 927,637,826 |
| 1914 | 1,026,376,381 | 18,666,521 | 1,045,042,902 |

In 1907, just after the Russo-Japanese war, another important period of expansion set in. At the close of this period, i. e., at the end of 1912, there were about 181,000 subscribers with a total length of interurban telephone lines of about 63,000 miles. Since 1912 the telephone is in a transition period and about 130,000 subscribers are awaiting installation of telephones. The third great period of expansion is figured to be the year 1916, basing the estimate on the demands of the public for service. To satisfy the latter will mean an expenditure of $11,225,000. The tables give an excellent picture of the growth of service.

From the technical stanpoint the development may be also divided into three periods: During the first stage the Gower-Bell telephone was used with call battery and was then replaced by the solid-back or the Delville apparatus with magneto. The subscribers' wires were overhead and plain bare wires. The interurban lines, two of them, extended between Tokio and Yokohama, and Osaka and Kobé. At the exchanges in the four cities standard magneto switchboards or multiple switchboards in series with magneto service were used, serving about 3,000 subscribers. In the second period, from 1896 to 1906, two-wire circuits were substituted for single wires and aerial and underground cables came into use. Improved magneto multiple switchboards were introduced in 1897 and kept until 1903, when the first common battery switchboards were installed in the Tokio exchange. Thanks to their excellent working they were installed in all large cities, the older magneto multiple boards being reserved for smaller cities with subscribers whose number did not pass 4,000. The longest interurban line between Tokio and Sasebo (about 880 miles) was finished in 1905 in view of the military need during the Russo-Japanese war. The third greater period began 1907. During this period common battery multiple switchboards were installed in all larger cities and the older multiple switchboards equipped with supervising signals. Underground cables with 400-pairs of conductors, which had been tested up to this period, were now used in the big cities instead of the overhead wires and in 1914 experiments were also made in Tokio and Osaka with 600-pair cables. It should be noted that the government made extensive tests with

cables insulated in an enamel sheath and that these have been used in the Shiba exchange in Tokio since 1908. As they showed excellent results in regard to resistance to humidity they have been used extensively in other exchanges. This was the first practical attempt anywhere with enameled cables.

As concerns the telephone instruments and equipment more than 30 per cent were furnished up to the last few years by American and European manufacturers. The efforts of Japanese manufacturers cut this down in 1914 to 5.6 per cent. At the present time only the iron wires, steel and some other minor materials are imported from foreign countries; all else is procured from the home industry.—*Annales des Telegraphes et Telephones.*

### USE OF PUPIN COILS WITH IRON WIRE.

German telephone service has been changed by the order of the Department of Public Works by using iron wire to wind around the Pupin coils, in order to save the copper. Tests made with such telephone lines have shown that communication is possible when using iron wire, provided that the weakening effect is not too great and the distortion is kept within bounds. According to the results found, it is possible to obtain a satisfactory service up to 120 miles. Within this limit the iron pupinized coils have given good results. The considerations which tended to favor the adoption of iron telephone wires are the following: (1) very short iron telephone lines (up to 18 miles) need not be pupinized at all. (2) It is convenient to pupinize all the other lines with iron wire, as the weakening effect and the distortion are not unfavorably influenced. (3) One can use iron for telephone lines only under certain conditions: (*a*) telephone traffic is carried on over uniform iron wires; (*b*) service is carried on over a mixed line composed of iron and bronze wire.

For lines constructed entirely from iron the length must not exceed 120 miles. If greater distances are to be bridged, unless Pupin coils are used, it is necessary to use short lines of bronze wire and connect these to the iron wires. The bronze wires can bridge the longer distances and the iron wire can be used for communication within the city and to the subscribers' instrument.

When bronze and iron wires are used together the following table shows the lengths which can be connected without disturbing conversation efficiency. It is assumed that the iron wires are of 4 mm. diameter (pupinized) and the bronze wires of 2 mm. wire (not pupinized). Under these conditions composite lines can be installed as follows:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 120 | miles of | Pupinized | iron wire | relayed to | 6 | miles of | bronze wire. |
| 102 | miles of | Pupinized | iron wire | relayed to | 24 | miles of | bronze wire. |
| 78 | miles of | Pupinized | iron wire | relayed to | 48 | miles of | bronze wire. |
| 60 | miles of | Pupinized | iron wire | relayed to | 60 | miles of | bronze wire. |
| 30 | miles of | Pupinized | iron wire | relayed to | 90 | miles of | bronze wire. |

If the bronze wires are also pupinized, one can employ almost double the length. One point must be carefully remembered and that is: That the telephone exchanges, even when they are situated within the 120-mile limit, must not be connected to each other by iron wires, since the communications exchanged between the exchanges and the subscribers would exceed the 120-mile limit. But since such cases are rare and since under such conditions some verification of messages might be employed, it might be possible to connect exchanges within the same city, not far from each other, by iron wires.

Iron wires, as with all other metal wires, must be transposed. As telephone and telegraph wires are connected to the same poles, the crossing can be simplified and distances reduced as much as convenient. If telephone cables are used, these should be pupinized every 6/10 of a mile. Iron telephone lines must be strung with particular care, especially as to soldering. The first telephone installation with iron wires was introduced along the Danzig railway line. Pupin coils are placed every five miles.—*Annales des Telegraphes et Telephones.*

## Intensified Telephoning in Los Angeles

The telephone exchanges of the city of Los Angeles handled 365,000,000 telephone calls during the year 1916, an average of 1,000,000 per day, or two calls for each inhabitant. The total number of calls handled on the exchanges of the States of California, Washington and Oregon averages 3,500,000 per day and of this vast number Los Angeles exchanges alone handle 1,000,000, or 30 per cent of the total calls made on the Coast each twenty-four hours, according to figures given out by officers of the companies.

The Pacific Telephone and Telegraph Company, with its 70,000 instruments, handled 182,500,000 originating calls during the past year and the Home Telephone Company 182,500,000 on its 63,000 instruments. This does not include the in-calls, or the long distance connections of the Bell system, and it is a very conservative estimate of the Home company's business as the use of the automatic instrument makes it practically impossible to keep accurate account of the calls made on these instruments.

These figures show that Los Angeles telephone exchanges handle practically double the number of calls registered by the telephone system of San Francisco alone and that the calls are equal in number to all the calls made in the entire bay region, including San Francisco, Oakland, Berkeley, Alameda, Burlingame and other environs.

New York City had a daily average of 29,420,000 telephone calls on the Bell system during 1916, which means approximately 100 calls a year for every man, woman and child in the United States, according to the company's annual statement.

## Certificate of Necessity in Ohio

Governor Cox's office was crowded Monday afternoon March 5, when the telephone men of Ohio called to protest against the forms in which the Apple and Gilmore bills passed the state senate.

The protest was made by the Independent telephone men, but representatives of the Bell interests also were present. Governor Cox said he realized that corporations that are giving honest service at fair rates must have protection.

The bill, as passed by the senate, was reconsidered after it had been returned from the house. By a vote of 15 to 10, the senate struck out, by reconsideration, the Terrell amendment, changing the entire character of the bill. The amendment was then voted down, leaving the bill in its original form, merely a bill to require a certificate of public necessity from the state utilities commission if a utility is to invade a field already occupied.

The amendment taken out removed the requirement of public certificate necessity and exempted mutual telephone companies from the law. The bill was saved from death through defeat of a motion to recommit, but later was defeated by a vote of 14 to 17. The end of the telephone men has been gained.

# Operating Railway Selectors Without Batteries

*Address Before the Superintendents of Railway Telegraph*

BY J. G. WRAY

A RAILWAY telephone dispatching circuit showing the method of applying the current furnished by primary battery for the operation of the various selectors bridged between the line wires, and also how the telegraph simplex circuit is obtained, is shown in Figure 1.

A separate bank of battery for the main line selector signaling current must be maintained for each circuit equipped with a simplex circuit.

In Figure 1 *F* represents the telephone and *S* the selectors bridged between the line wires, *A* and *B* relay points, which are operated by the dispatcher's selector keys of master selector, *CX* the simplex composite, *T* where telegraph is connected, *B* the main line signaling battery, *R* the retard impedence in the main line signal impulse battery circuit. This impedence rounds off the signaling impulses so as to not produce a disagreeable sound in the telephone receivers.

The scheme which has been referred to as a "battery saving device," is shown in Fig. 2. Note the changes made. Relay points marked *A* and *B* have both front and back contracts; the primary battery *B* has been replaced with a bank of condensers (*C*) connected in multiple. The back contacts of the relay points (*A* and *B*) are connected to a D. C. power circuit, which may be grounded.

On the C. R. I. & P. Railway two installations of this equipment have been made, one on a circuit between Des Moines and Council Bluffs, Iowa, and the other on a circuit between Manly and Valley Junction, Iowa. Both of these circuits have been operating successfully for months.

At Des Moines, Iowa, the power circuit used is the City Edison, three wire, 110-225 volt D. C. electric light and power circuit, neutral wire of which is grounded. We use the 225 volt lead a 20 ohm lamp was installed at the point marked *L*, to slow down the charge of condensers *C*, so as to overcome the welding effect of the relay points.

It was found that with the 8,000 ohm, local battery bell type Gill selector, that with two 2mf condensers for each selector on the circuit very satisfactory results were obtained. The line at Des Moines is 141 miles long, line wire 210 lb. copper, and has on it 25 selectors. Fifty condensers, 2 mf each, or 100 mf total, are used in the signaling bank marked *C*. Each time an impulse is sent to line the condensers are returned to the power circuit for a fresh charge; the only necessary current required is used for the line signal, if more condensers than necessary are installed in bank *C* a complete discharge to line does not occur when the impulse is sent out, consequently the condensers do not have to absorb a complete charge from the power circuit when recharging and no harm results.

On the dispatchers' circuit Des Moines to Council Bluffs it was necessary to replenish the bank of about 190 cells of battery about every six months, or a total of 380 cells a year were used.

At the time the condensers were installed our supply department was charging us about 25 cents for each dry battery, which would make the battery cost per year $95 for this one circuit.

Now, I wish to show you how the power cost figured out with the condenser bank scheme.

The Gill selectors used on this circuit are the ring in eight second type. I will assume that under ordinary conditions for figuring with all impulses added together the current flows to line for a total of four seconds each time a call is made, 300 calls are made each 24 hours, and three-tenths ampere is the current flow at 225 volts (this current figure being somewhat more than actually used).

Three hundred calls multiplied by four seconds equals 1,200 seconds or 20 minutes per day. 225 volts x 3/10 amperes equals 67½ watts per call of 4 seconds. 67½ watts x 20 mins. (⅓ hour) per day, equals .022½ kwh. per day. .023 kwh. x 30 equals .69 kwh. per month equals $3.45 at 5 cents per kw. .023 kwh. x 365 less 8.395 kwh. per year.

A fair average cost for power is 5 cents per kwh., therefore the cost of power used for this one circuit will be about 42 cents per year.

At Des Moines 50 No. 21-D 2mf condensers at 75 cents each were used. A wooden box with wooden separators between all condensers was provided, the ordinary impulse relays were replaced with two telegraph pole changers, one 20 ohm lamp and socket were inserted in the power circuit. The entire installation cost, including labor, was about $50, where as a six months renewal of the dry battery would have been $47.50.

It was found that the selectors worked better with less voltage to line than they had operated on the dry battery.

The reason the selectors may be operated with less voltage in the condenser bank than is required in the dry battery, is due to the fact that the condensers have very little internal resistance, whereas the internal resistance of the dry cell is a factor that must be taken into consideration.

The impulse to line is always the same with condensers and power whereas with the dry battery there is necessarily considerable voltage and current change as the battery deteriorates.

If for any reason the telephone wires become crossed the source of power is not destroyed as with dry battery, the condensers simply empty to line and go back and get a fresh load. This condenser signaling scheme may be operated from a commercial D. C. light and power circuit, or any other direct current power circuit of proper voltage.

This scheme will prove in on any mechanically held type of selector, by mechanically held I mean a selector that the local contacts are held mechanically and not electrically closed during interval that the station bell is ringing.

The W. E. Co. relay type, mechanically held selector required in the main line bank about 8 mf for each selector on the line. The Wray-Cummings clock selector requires about 24 mf in the main line bank for each selector on the line, and I do not think the Wray-Cummings type of selector will prove in on account of the condenser cost. The reason why the clock selector requires so much more capacity in the main line bank is due to long starting impulse that is first sent to line to insure starting all the clocks on the circuit.

This condenser scheme will operate successfully practically all types of selectors, but it will not prove in financially with all of them.

The annual maintenance charge for this scheme outside of the power cost should be only for the signal relay points and relays as the condensers should last indefinitely.

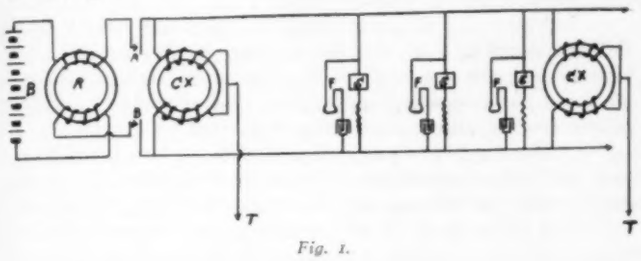


*Fig. 1.*

The system can be used where there is a telegraph machine current, storage, or any other source of direct current. They must have a separate bank of condensers on each circuit. You may have with direct current a source of power on which you can charge and operate any number of dispatching or message circuits, and simplexes will not interfere.

With the Gill selector the capacity of your condensers runs about 4 mf per selector bridged on the wire.

The current demand on the Gill selector per station runs about 4 mf to the selector. It will work with a little less than that.

On the clock circuit, it won't prove in, because it takes too much condensing capacity to operate the impulses; you would have to put on so many more condensers to hold up the relays at the various stations. I also tried it out on the Western Electric relay type of selector, with a main line relay in the station, and it didn't prove in on that, but it will work all right on the mechanically held type of selectors. It will work with the Automatic Company's selector all right.

The next circuit I wish to explain is a circuit for the use of commercial alternating electric light and power current for main line selective signaling on a telephone train dispatching circuit, on which a telegraph circuit will be shown. This circuit, with slight alterations, may be applied to any telephone dispatching circuit of which I have knowledge. The A. C. current may be stepped up or down by means of transformers to meet voltage requirements of the signaling circuit. This circuit may also be called a battery saving device.

The main line equipment remains the same as in circuits 1 and 2; all changes are made in the signaling battery equipment or power circuit. The signaling relays *A* and *B* remain the same as in Fig. 1, but additional relays *C* were installed in the alternating current circuit, and an additional retardation coil (*R-2*) and condenser (*C*) have been added to the impedence equipment; a four valve type of chemical rectifier (*MC*) is used to rectify or straighten out the A. C. current so that it flows in one direction only; a transformer or repeating coil (*x*) is used to make the A. C. current metallic, and also isolate each signaling circuit where more than one is used on the same source of A. C. power. Commercial A. C. power circuits are generally grounded on one side of the service transformer and if the signaling current is not made metallic, impulses sent to line would interfere with the grounded telegraph on the simplex.

Circuit No. 3 is shown as originally installed, and experiments have not been made, but it is believed that impulse relays are only necessary in A. C. Power circuit where relay (*C*) is shown. In this case the impedence equipment would be connected direct to line wires.

Several installations of this device are contemplated in the near future on the C. R. I. & P. Ry., in fact practically all our dispatching circuits will soon be operated with either D. C. condenser signaling scheme or with the A. C. transformer and rectifier. Nearly all our telephone dispatching circuits are equipped with simplex telegraph on which we have operated all classes of telegraph, including ordinary Morse, duplex, quad and printer circuits.

An installation of the A. C. equipment was made on the C. R. I. & P. Ry. between Rock Island and Burr Oak, Ill. The line wires are 210 pound copper, length of line 168 miles; the circuit is equipped with 30 Wray-Cummings clock selectors. The additional retard added is a 17 ohm Kellogg 29-A coil, condenser *C* 10 mf capacity. The rectifier is one manufactured by the McIntosh Battery and Optical Company of Chicago. It is composed of four glass jars, each of which contains a specially prepared chemical solution, iron and aluminum elements in a suitable box with a top of insulating material and necessary binding posts. The transformer or repeating coil used was Western Electric No. 37A repeating coil.

The rectifier was designed after two years of careful research work and this type was decided upon as producing best results, the most even D. C. current to meet the manufacturer's needs in the electro-therapeutic field. The Chicago Edison Company made oscillograph tests and photographs of the A. C. wave to the rectifier, and also the D. C. current from it, and it was found that the D. C. wave varied from 105 to 110 volts, that the current was not pulsating, but practically constant. I was advised by the McIntosh people that they originally used a rectifier in which one of the elements was composed of lead, but this type was discarded owing to the fact that a deposit formed on the lead element, which chemists could not analyze and could not be removed with sandpaper. When this deposit formed the cell was practically open to an electric current.

This rectifier has, as before described, four cells, each one is composed of a glass jar with a rectangular aluminum element and an iron element of the form of a half cylinder immersed in a solution of salts. The composition of these salts I am not familiar with. In my sketch I represent the aluminum element with the squares and the iron element by means of half circle. You will note that one side of the transformer in sketch 3 is connected to the aluminum elements of two cells and to the

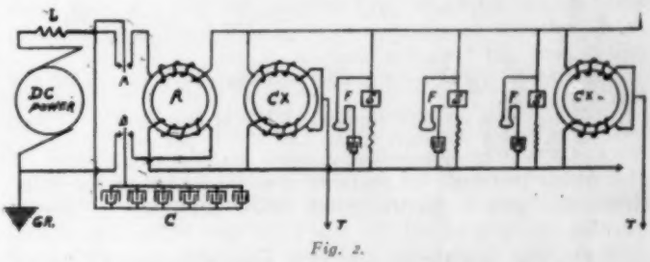


*Fig. 2.*

iron elements in the other two cells, also that the connections to point marked (*P*) for positive between the retardation coil and rectifier goes to two aluminum elements, and the connection marked (*N*) goes to two iron elements.

In setting up this rectifier first the salts are mixed with the water, distilled water preferred, and the ele-

ments are placed in the jars. The cells are next polarized; that is, a chemical action set up in the cells, this is accomplished by turning on the A. C. current through a lamp resistance so as not to short circuit the power until the lamp becomes a very dull red. The result is that a thin skin of gas bubbles is formed all around the aluminum elements. After this skin of gas is produced the cell is considered polarized and will remain so for a period of about 24 hours, after which if not used in the meantime the cell must be repolarized.

The current in this cell flows only from aluminum to iron, and each one of the four cells may be considered a valve that will let current through in one direction but not in the other.

You will note that each end of the transformer, winding on the side connected to the rectifier, is to an iron and also to an aluminum element, and that the rectifier is so wired that no matter from which end of the transformer the current floks out it will always come out of this four valve rectifier at the same point. Consequently the A. C. current is actually made a D. C. current, one-half of the cycle is turned over or rectified.

Some types of rectifier allow only one-half the A. C. cycle to pass through them, as any one of these four cells would do. The result is a pulsating current, which would not answer our requirements.

The A. C. current, after passing through this rectifier, sounds in the telephone receiver about like the current from a direct current machine, a D. C. volt meter needle stands absolutely steady.

The additional retardation coil was added to the impedence circuit to choke out or kill the machine hum that is caused by the variation voltage between each half cycle. The result on the dispatchers' phone is a faint, low, musical note in place of the soft battery chuck when impulses are sent to line.

On the Illinois Division, Rock Island to Burr Oak, we maintain 165 cells dry battery in the signaling bank at Rock Island, this battery as a rule would last about nine months, making our yearly cost for 220 cells at 25 cents each $55.00.

This circuit equipped with this type of selectors, Wray-Cummings, are naturally light battery users, as two impulses are sent to line to call one station, three impulses to call two stations, four impulses to call three stations, and so on; but to make figuring easy I will assume that the total current flow to line is for four seconds each call, and that there are 300 calls made a day, as we had in our previous example.

Owing to the fact that there is some transformer and rectifier losses, we will assume that there is used from A. C. current one-half ampere at 220 volts every time a call is sent out over the line.

½ ampere x 220 volts x 1200 seconds (⅓ Hr.) equals .037 KWH per day.

.037 KWH x 30 days equals 1.11 KWH per mo.

.037 KWH x 365 days equals 13.5 KWH per year.

13.5 KWH @ 5c equals 67½ cents per year power cost.

With this type of rectifier it is figured that the solution will have to be replaced twice per year at a cost of 75 cents a renewal for the four jars. The aluminum element will last about one year and will cost $1.00 per set of four.

Generally speaking, the maintenance for the circuit I have described would be 68 cents for power, $1.50 for solution and $1.00 for aluminum elements, or total of $3.18 per annum.

To mix fresh solution put in new aluminum elements and repolarize the rectifier, should not take a man to exceed thirty minutes. The iron element does not disintegrate.

The present price of McIntosh rectifier is $25.00, complete with 10 mf condenser. I have been advised by the Western Electric representative that their 47A repeating coil will meet requirements of this circuit, and I believe any good ring through telephone repeating coils will answer the purpose.

The price of 47A repeating coil is $4.25; the Kellogg 29A retardation coil, $10.00, making total cost for additional equipment $39.25. The installation expense for labor and incidentals, not including arranging for A. C. power circuit, should not be over $10.00.

In closing I wish to call attention to one thing some may not have noticed, and that is that you have for years maintained additional dry battery in your main line signaling banks to overcome unnecessary ohmic resistance in the battery impedence circuit. I know of installations

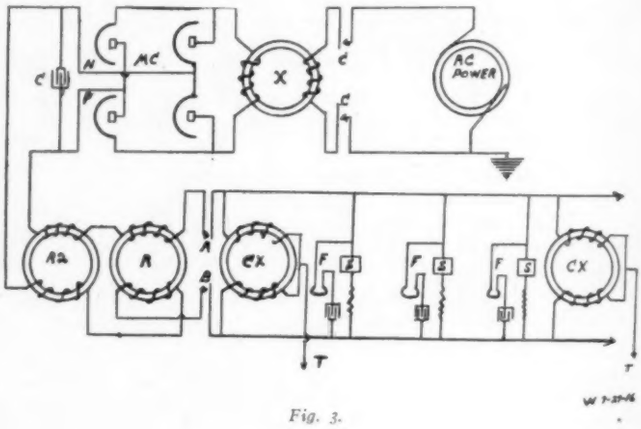


*Fig. 3.*

where the total resistance of the retardation coils is 200 ohms, equivalent to over 22 miles of 210 pound copper metallic circuit for the dry battery to flow through before it reaches the main line wires. The voltage drop around 200 ohms with 3/10 ampere current flowing with 60 volts. It takes about 43 cells of dry battery to give a pressure of 60 volts and overcome this resistance. These coils may be replaced with one or two of the 17 ohm coils referred to previously, which have more iron core and much less ohmic resistance. The voltage drop around a 17 ohm coil with 3/10 ampere flowing is 5.1 volts and it would require less than 4 cells dry battery to overcome this resistance.

To the best of my knowledge the scheme for the use of the A. C. current for signaling impulses on a telephone train dispatching circuit is new and somewhat original and has not been covered by patent.

In the rectifier there are 4 iron and 4 aluminum plates. There are different types of rectifiers on the market. Some of them have iron and lead elements, but the lead, after being used for some time, became covered with oxide.

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## Californians Petition for Connection

Petitions asking that interchangeable switchboards be installed jointly by the Pacific Telephone and Telegraph Company and the Home Telephone Company have been presented to both companies at Santa Monica, Cal., by a committee of the Santa Monica Merchants' Association, headed by Neil Nettleship.

# Effect of Recent Decisions on Appraisals

*Presented at the 326th Meeting of the American Institute of Electrical Engineers, New York*

BY PHILANDER BETTS

DURING the past few years there has been much discussion on the proper basis for rates. This discussion has been quite confusing at times because of the entrance into it of those who were not familiar with all sides of the question. That is, engineers not familiar with the existing legal decisions have argued pro and con on the subjects of valuation and depreciation, and lawyers not familiar with development cost have based their arguments entirely on the decisions of the courts.

If we are to have proper respect for our courts, we must abide by their decisions and, if not satisfied, we must familiarize ourselves with all of the conditions leading to the courts' decisions. Probably the earliest cases which begin the history of decisions concerning valuation are those of the Brunswick and Waterville, Maine, cases. We must bear in mind, however, that those were cases in which negotiations were in progress looking to the sale by water companies of their properties to the municipalities. In those cases the franchise rights had either expired or the municipalities had the right to take over the properties as well as the franchises, and thereafter operate them. In "purchase and sale" cases, clearly the matter to be determined is the *value* of the property, all things considered, including "going concern" values if any exist. After a study of many of the great rate cases, the writer has come to the conclusion that the confusion of mind has come from the fact that the early decisions were based upon "purchase and sale" cases and did not primarily have anything to do with cost in its broad sense.

### VALUE NOT COST.

If we are, however, to do our work in conformity with the courts' decisions, we must take as our primary basis for the consideration of rates, the value of the property and not necessarily the cost. Justice Harlan was wiser than he knew when, in the famous case of Smyth vs. Ames, he said as follows:

> We hold, however that the basis of all calculations as to the reasonableness of rates * * * * * must be fair the value of the property being used by it for the convenience of the public. And in order to ascertain that value, the original cost of construction, the amount expended in permanent improvements, the amount and market value of its bonds and stock, the present as compared with the original cost of construction, the probable earning capacity of the property under particular rates prescribed by statute and the sum required to meet operating expenses, are all matters for consideration and are to be given such weight as may be just and right in each case. We do not say there *may not be other matters* to be regarded in estimating the value of the property. What the company is entitled to ask is a fair return upon the value of that which it employs for the public convenience. On the other hand, what the public is entitled to demand is that no more be exacted from it * * * * * than the services rendered by it are reasonably worth.

### REPRODUCTION VALUE VS. ORIGINAL VALUE.

The general trend of recent decisions has been to make reproduction cost the sole or controlling basis of value for rate purposes. Some courts plainly state that, in their opinion, actual cost, capitalization and other factors are to be considered only to the extent that they may throw light on the cost of reproduction or existing depreciation. In support of this principle, the opinions of the Supreme Court of the United States, indicate that it is the "present value" of the property that is to be determined; thus, in Smyth vs. Ames, reference is made to "the fair value of the property being used . . . for the convenience of the public"; in San Diego Land and Town Company vs. National City, it is "present value"; in the same case, on appeal to the Supreme Court, Justice Harlan refers to "reasonable value of the property at the time it is being used for the public"; this is quoted as settled law by Justice Holmes in 1903, and by Justice Peckham in 1909 in Wilcox vs. Consolidated Gas Company. It is argued that this constant use of the present tense by the Supreme Court in referring to fair value for rate purposes must at once exclude actual cost or original cost from having any controlling influence in the determination of fair value. Under this interpretation present value must be based either on market value or reproduction cost, and as market value is not usually considered a fair or possible standard for rate purposes, reproduction cost is turned to as the only available standard. This line of argument would be more convincing were it not for the fact that in the leading case of Smyth vs. Ames in which the present value principle is laid down, it is also distinctly stated that both original cost and reproduction cost shall be considered in determining a fair present value, and it is no indication that either of these factors should be given a controlling influence. This cannot be accepted as the settled rule of law as the whole subject of valuation is still in a developmental stage. The Supreme Court of the United States has wisely refrained from laying down a hard and fast rule which might have to be reversed when all of the factors of the problem shall have been more clearly discussed.

### VALUE NEW VS. DEPRECIATED VALUE.

In the so-called Idaho case, it has been determined by the court that the value new of the property is the proper basis for computation of rates rather than a "present value" obtained by deducting the full estimated depreciation. This decision follows a number of commission decisions along the same general line and is best expressed in the words of the St. Louis Public Service Commission in the case of the Union Electric Light and Power Company of St. Louis, decided in 1911, "In depreciating, to arrive at the present value, the Commission does not consider it fair to make deductions for anything but the present physical condition and for items where it is plainly apparent that the property has become obsolete and inadequate."

### PROPERTY USED AND USEFUL.

From the earliest cases down to the present time, the courts have been unanimous in the determination that the basis for rates must be the value of the "property used and useful" and have not been very definite in further defining these terms. The commissions have, however, in a number of cases, after determining the value of the entire property, made deductions for property considerably in excess of that required for the present customers or those who might be taken on in the near future. This has sometimes occurred, and occurred recently in New

Jersey, where companies have been too optimistic with regard to the development of the territory and have built plants far in excess of the actual needs. It also follows from this, that rates may not be based upon an inadequate plant but that the valuation to be determined will be that of a plant adequate in all respects for the customers now connected and including a reasonable reserve for customers who may be taken on in the near future, as well as reserve to guard against the ordinary breakdowns and interruptions in service.

CLASSIFICATION AS TO USE.

The next decisions of interest affecting our work of inventory and appraisal are those of the Norfolk and Western Railroad Company vs. Conley, et al, and the Northern Pacific Railroad vs. the State of North Dakota. The effect of these decisions is to require different rates for classes of service where the costs are greatly different. The basis for differential rates is found in one of the earliest Supreme Court decisions in which it was held that "what the company was entitled to was a fair return upon the value of that which it devoted to the public use," but the court went on to say that what the purchaser was entitled to was "service at no more than the worth to him." This decision practically confirmed the railroads in their existing practices of having different rates for different classes of service. With regard to electric lighting and power companies, it has been customary to classify customers in accordance with their requirements for service. This classification, however, was based on and adhered more or less closely to the cost for the respective classes of service.

RESULT.

The result of the above mentioned decisions is that the inventories and the resulting appraisals must be classified in accordance with the use and the extent of the use. So far as the engineer is primarily concerned with cost, the inventory and appraisal will arrive at the same aggregate in any case, but the engineer is further concerned with the use and operation of the electrical property and it is the duty of the engineer to determine to what extent each class of property is required in the service of the public and to what extent it is required for the furnishing of the various classes of service. In preparing our inventory, therefore, such classifications must be made as will readily show the use to which the property is devoted. In the determination of rates it becomes especially important when it is recognized that charges for municipal street lighting have almost invariably been lower than the proper proportionate costs for this class of service, and where a company has been reasonably successful in carrying on its business it follows that the rates charged for other classes of service have been too high and the recent court decisions forbid the collecting from one class of customers any unreasonable portion of that which ought to be collected from other classes of customers, and further forbid the lowering of rates for reasons of public policy.

As to the calculations for depreciation, while the Idaho decision is to the general effect that full or theoretical depreciation should not be deducted in obtaining the fair value of the property, it cannot be said that this principle is at all well established, and it becomes necessary, in our inventory, to determine the accrued depreciation of each item, taking into account not only ordinary wear and tear, but obsolescence and inadequacy (which some authorities call functional depreciation). The writer has long been of the opinion that in order to square our valuations with the court decisions, we must (1) obtain definite appraisals of the existing physical property, (2) ascertain the full theoretical depreciation, (3) make such deductions as are necessary because of property built unwisely or for anticipated increases in population which have not materialized or for classes of service which have not been taken on. In other words, our valuation must be determined by using our best present-day judgment as to the amount and classes of property required to serve the customers now connected and those which may be connected within a reasonable future period.

This may even involve an addition for property not now in place, but which ought to be in place in order to assure continuity of service with the requirement that same be installed. In addition, however, to the value of the physical property, the writer desires to take refuge behind the words of Justice Harlan when he says, "We do not say that there may not be other matters to be regarded in estimating the value of the property." It is the writer's contention that in making the appraisal of the physical property, due allowance must be made for overhead charges. In addition, however, there are allowances for various intangibles not properly included under the head of overhead charges. They are (1) cost of organization and obtaining the necessary charters and franchises, (2) deficits in operation in the early history of the project, (3) lack of profits in the later years and (4) the unearned depreciation which has accrued. It is the writer's further opinion that the aggregate of these elements ought to bear some favorable relation to the total value of the physical property but it is the province of the engineer to investigate and determine the various items referred to with the exception, perhaps, of items concerning the cost of organization and obtaining the necessary charters and franchises. All other elements in determining the appraisal and valuation of a public utility property and in the determination of the deficits, lack of profits or otherwise, are matters solely within the province of the engineer.

COST OF ESTABLISHING.

The above items should be considered as making up the "cost of establishing the business." There has been much contention with reference to the necessity of including "going value" but here again we are confusing cases involving justice to the investor with "purchase and sale" cases. "Going value" is an element to be considered in "purchase and sale" cases and has no pertinency whatever in rate cases. The United States Supreme Court, in its recent decision regarding the Des Moines gas rates, decided that "going value" was to be considered in these cases but based its estimates of "going value" on those elements which go to make up the "cost of establishing the business." In the determination of reasonable or fair rates, full consideration must be given to the sacrifice made by the investor. This will include, in addition to the investment in the physical property, early losses, lack of profits and unearned depreciation, the aggregate of which should be classified as the "cost of establishing the business."

CONCLUSIONS.

1. Property must be inventoried in such detail as will lead to a determination of its value or cost within a very small percentage of absolute accuracy.

2. It must be classified as to its use and as to the degree of its use in the various classes of service.

3. The inventory must include full information as to age and present condition, this information leading to accurate estimates of accrued depreciation.

# The Soldier Lineman

*From the Telegraph and Telephone Journal, London, England*

BY CAPT. A. A. JAYNE, R. E.

At the commencement of the war the number of linemen on active service was very small. Of course there was "K" Company, R. E., which left its work with the Post Office in Ireland very abruptly on mobilization and came to France to work mostly on lines of communication, that is, building and maintaining lines from the base to G.H.Q., and afterwards on to the Army Corps. Then came the Special Reserve, a very small number, consisting of post office telegraphists and permanent linemen, and they were spread over G.H.C., corps and divisional signal companies. They were also with the original expeditionary force.

As the army began to grow the call upon the post office for linemen increased correspondingly, and now, judging from the number I see out here, there must be very few left in England. The old military post office lineman is now an infinitesimal percentage of the total of present-day post office linemen in the army.

These notes are written with a view to sounding forth a note of the deepest appreciation to the post office for the engineers, the telegraphists, and the linemen they have unstintingly supplied to the army signals. Not alone for the *personnel*—for the material. For the never-failing supply of stores of all descriptions, telegraphic apparatus and the now multitudinous number of telephones and telephone exchanges. For the expert advice on problems which are always facing the army signals during this war; in fact for everything which has made our army signal service what it is—efficient, up-to-date, reliable.

People may well ask who is responsible for directing this trained *personnel* into the proper channel so that, in spite of the growth of the army and the extension of the battle front, the telegraphic and telephonic organization grows with it and produces a system that compares favorably with communications during peace.

They may well ask, for I am certain they will never be told by the gallant officer himself.

And it must be remembered that in spite of the drain upon men and material from the post office for France and other parts of the world, there is the defence of England to be maintained, and there is the everyday commercial and social life of England to be kept going. How it is done in England I am unable to say since war started, but that it is done I know for I have tested it during those "little bits of heaven," known as short leave.

I *can* speak, however, regarding France, for I have watched our signal service grow from the days when Field-Marshall Sir John French used to give us notice the evening before that he wanted "his telephone" fitted up at his command post early the next morning and we used to join up the only trench telephone working "up the line" from G.H.Q., to the present day when G.H.Q., army, corps, divisional and bridage headquarters have as complete a telegraphic and telephonic system as busy commercial towns.

Such a system is obviously another proposition at the front than during peace, and it is just this that has called for all the courage and skill that our trained *personnel* can produce, and upon no class has it made greater demands than upon linemen.

Can anyone say too much for them? Wet or fine, day or night, shelling or no shelling, they work away with skill and patience until their task is done. They seldom fail one in spite of the fact that it would often be extremely difficult to convict them of negligence if they did, and this attribute alone speaks wonders for the training and discipline they had in the post office.

Rugged of features, rough of hands, simple of speech, they will sit perched unmoved on high poles connecting lines through, despite everything—icy winds and often shells flying 'round them, wet through to the skin.

How often have I stamped around at the bottom of poles trying to keep warm while the lineman up top never turned a hair. He knows certain lines must be through at a certain time and one's cap may lift with the anxiety of it, feverishly watching every minute of one's watch, but he is unmoved. Then the welcome sound, "Hullo, 129th Brigade, is that O. K., give us a ring," and so the list is gone through and with a sigh of relief you move away to the next job.

I used to feel inclined to be irritated with linemen who spoke in broad dialects, though I took care never to let them see it. After all, perhaps, there is a little excuse for one when the mealtimes go flashing by and still a lot to be done. But Scotch sounds sweet at bad times when the call comes, "Hullo, sir—that line to X Battery is through and working, sir."

An autocrat is the lineman to people outside the signal service—he brooks no interference. "My officer told me to do this and you can go and see him about it," is the regular attitude. A general came in the hut one day and told me, "I rang up on the telephone just now and said, 'Give me the . . . Brigade, please,' but someone with a loud voice replied, deliberately and distinctly, *'Git off the blinking line.'* Of course I got off, but as soon as *convenient* I should like to speak." I apologized and explained that the line had been down and was being repaired. He went off with a merry twinkle in his eye.

Said a corporal to a class of learners: "Now you don't handle armored cable same as you would an *armored train,*" and his elementary disposition came on top, I thought, when he commenced a discourse on preventing damp on test boards by "Now you all know that water is an ever-present evil!" A stout fellow this, though, with a heart of gold. For five days and nights he sat in shell holes under heavy barrages of hostile fire joining cables through and making joints as calmly and skilfully as if he had been sitting doing the same work in a test box in Cheapside. Not a single fault was found in any of his work, for which he was immediately awarded the military medal. I saw him a few days after but he was not wearing the ribbon, and upon my asking him about this, he quite honestly and almost stubbornly said, "Well, sir, why should I have a medal when you think of all those poor fellows killed and wounded? Makes what I did very small." I said: "You saved many other lives by your work, but if you don't think you are worth it, the king does. Moreover, it being the king's medal, you have no option but to wear it." "Well, in that case it's different. I never looked at it in that light," he replied. He put the ribbon up at once.

Nobody but those who have to work the lines can fully realize the chaotic tangle they are in around some places. It generally takes a good day to sort things out even roughly. On the second day one calls the linemen together for a conference as to what is best to be done—by that time they also have some idea as to where the lines go. Then is the time to listen with what patience one may have to detailed descriptions in north country, cockney and south country, as to the routes they follow.

"Now then, Sapper Jones, where does that pair go that cross the road from the house bracket?"

"Well, sir, that's a pair to R × P."

"What's that?"

"Well, sir, R × P is a place about two miles up the road just out of Lee Tinkles."

"Lee Tinkles, Lee Tinkles, let me see, where's that?" Deep diving into maps.

"Oh, yes, I've got it. Right, go on."

"Well, sir, that used to be an R.S.O., but he's moved out and it's now a 'Casualty Clearing.'"

"I see, then this line runs to the Casualty Clearing Hospital at R × P?"

"No, sir, you see this pair which is P × 13 and 14 on the railway was cut at the junction pole on the level crossing this side of 'Lee Tinkles,' drops down to P × R 17 and 24, and after three bays, goes off on comic poles till it reaches the house standard over the French Civil, then it goes on house brackets, which, by the way, sir, are *some* brackets. We shall have to get a party up there and put some poles in with side arms, for while I was up on one of them tracing the pair through it was going up and down like a see-saw."

Pause to make a note *re* poles with side arms.

"How many poles do we want there, Sapper Jones?"

"Eight, sir, but one of them will have to be a good 36-foot pole, because one of the houses comes right out into the side walk and we shall have to get the wires over the house."

"Thirty-six-foot pole, eh? We can't get any poles that size nowadays."

"Well, sir, I know a place where there *is* one."

"Sapper Jones, don't you get moving any poles from anywhere unless I tell you. We must buy it. Who owns it?"

"Oh, it don't belong to anyone, sir, least, I never saw anyone when I was doing a scout round."

Note *re* pole and owner thereof.

"Well, we must get the farrier to make us seven braces, etc., for the side arms. Is the farrier around?"

"Yes, sir, but he's busy getting his forge to go."

"Doesn't it go? What's the matter with it?"

"Don't exactly know, sir, he said he was going round to-morrow to see if he could knock up some bellows for it."

"Right, well we must hire a civilian forge. Is there one?"

"Yes, a bit of a one, but from what I could make out from the old girl there, her son has gone for a soldier. The old girl uses the forge for making various 'fakes,' but when it comes to shoeing horses, she's a bit out. Some of the R.F.A.'s in the billets along that street give her a hand with the shoeing, but it's her living, so to say, and she wants four francs a day for hiring it."

"Well, we can't pay four francs a day, one franc is about the price."

Note *re* forge.

"Well, now what about this pair?"

"Well, as I was saying, sir, when we come to the end of that street where the forge is, the 'Roo dermeans' (Rue d'Amiens), it drops down on cable because the main route goes along the 'Rue de Or,'—it looks as if the town major used to be in circuit on this line—then it goes along until it meets the French route to the railway where it comes back to join P × R 13 and 14 to the R.O.D.'s hut at Wangaree Siding. He has a switch on to the Casualty Clearing just at the back."

"I see, well, that's that pair." And so it goes on and one sees weeks of work getting the lines together into some sort of order. This is where your linemen come in, and with many villages in like condition it would be quite impossible to work the signal service efficiently without their skill and patience. Of course such lines if left alone would work after a fashion, but one always has to keep in view the possibility of enemy shelling, and it would be a serious business if fighting lines, even if in order, were down, though only for a short time, but disorganized lines down, would be—well, I don't like to think about it.

The case of one lineman stands out in my mind. For weeks we had been clearing up a certain small town and on the last job of all I saw him up a pole with his mate assisting. Stopping just to say, "Well, this completes everything, does it?" "Yes, sir," he replied, and I passed along. An hour afterwards I heard that the lineman on the pole had been killed by a bomb and the other man seriously wounded. The route was down but it didn't take long to get right.

I had only known these men a year, but if ever men had fought a good fight and finished their course, these men had. In a humble sphere in the post office they achieved work for the army of which the weekly wage or the yearly salary is never, never even an approximate measure.

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## The Art of Speech

The mystery of the art of speech, from the first to the last word, was solved by the Chicago Woman's Club, represented by the newly organized committee on public speaking and correct speech.

Not only did the committee snare and conquer the elusive vowel and the phlegmatic consonant, but it started training them to lie down, play dead, stand up on the hind legs and beg, or hop, skip and jump blithely from the tongue.

It's simple and cheap. All one needs is a garden of roses. The petals of the potato vine are useless. Mrs. Catherine Moore of the Bell Telephone was the mentor. She led the members of the club through the labyrinthine mysteries of articulate sound.

"You simply blow upon an American Beauty," explained Mrs. Moore; "that is the first lesson we teach our girls."

"What a dreadfully expensive manner of teaching," murmured a club member.

"They may be imaginary roses," continued Mrs. Moore. "All one must do is to concentrate—the rose does the rest. The thought waves emanating from the concentration induces a superserene state of mind.

"This influences the entire personality, and the vocal chords reacting to it, a pure, sweet tone of voice is produced."

"Snuffing candles is just as good," volunteered Miss Grace Dixon. "We are using them successfully in the School for Crippled Children."

A silent vote showed the roses had it, however, and the committee adopted the diction methods of the telephone company.

# Scandinavia's Telephone Trade

*Our Old Friend, Western Electric's European Traveler, Reports to the W. E. News*

BY E. A. BROFOS

WAY up north, looking down upon the rest of Europe, we have the Scandinavian countries, whose inhabitable state largely is due to the Gulf Stream. The effect of this circulation of tropical water is such that these countries bordering on the latitudes of Alaska have temperatures that even permit the growing of tobacco.

From a Western Electric commercial standpoint, Scandinavia, comprising the three independent kingdoms, Norway, Sweden and Denmark, together with Finland which belongs to Russia, are considered a district. The four countries represent about 8.4 per cent of the total area of Europe and, with fourteen million inhabitants, about 3 per cent of the population of Europe.

The chief income of these countries is from agriculture, but manufacturing industries are prominent in Sweden and fishing and shipping of particular importance in Norway—commanding as she does the third or fourth largest commercial fleet in the world with a tonnage per inhabitant of the country about 120 per cent ahead of the tonnage of England.

*Einar Brofos Himself—On the Job, as Usual.*

The war has influenced conditions in Scandinavia considerably just as it has in America. The cost of living has rapidly increased, so at present it is some 70-80 per cent above the pre-war state. Fortunately, however, there have been exceptionally good times during the last year, to a large extent due to the great Scandinavian commercial fleet in active service. It is thus noted that most Norwegian coast towns doubled their taxable incomes for 1915 in comparison with 1914. The deposits in the leading Norwegian banks increased about 70 per cent from April, 1914, to the same month 1916, while the gold reserve of the National Bank increased from 78 million Kroner in October, 1914, to 233 million Kroner in May, 1916.

Possibilities for electrical development in Scandinavia and Finland are very great. This is especially true of Norway and Sweden, the former country being in an exceptional position as regards hydro-electric power, due to the mountainous condition with the numerous mountain lakes permitting a steady regulation of water. The possibilities for hydro-electric power in Norway are estimated from 10 to 15 million horsepower. Considerable of this power has already been harnessed, most of it being used for electro-chemical purposes. Production of saltpeter by fixation of the nitrogen of the air is of special importance. One such company claims to have the largest hydro-electric power-plant in existence, producing some 300,000 horsepower. As for Sweden, hydro-electric power for the electrification of the railroads there is rapidly going forward.

Telephone developments in these Northern countries is the highest in Europe, thus, Norway, Sweden, Denmark and Finland comprise about 3 per cent of the pre-war population of Europe, but have 13-14 per cent of the telephones. Considerable private activity is identified with telephone operation in these countries in contrast to what is usually found throughout Europe. In Denmark practically all local service is operated by eleven private companies, while the government furnishes the long distance service between the various districts and with foreign countries.

Of the Western Electric installations in this country, there are 5 common battery exchanges, belonging to the well-known Copenhagen Telephone Company.

In Sweden the government operates practically all local and long distance service, with the exception of the important Independent Telephone Company of Stockholm which operates within a radius of 50 kilometers of the city and has about 70 per cent of the telephones of Stockholm.

The Swedish Administration about one and a half years ago placed in operation an 800 line Western Electric automatic exchange, which is being increased to 1,200 lines. It is the first operating city automatic exchange in Northern Europe.

In Norway the local service is practically equally divided between the government and two hundred and ninety-seven larger and smaller private companies. The long distance service is operated by the government. Magneto systems were exclusively used in Norway until our company some three years ago started to introduce common battery systems. Since then the private companies of several towns have followed suit.

In 1913 the private telephone company in Bergen, the second largest town in Norway, contracted for a 5,000-line automatic exchange and subscribers' equipment. The installation would have been a model one. However, the great fire in Bergen destroyed both the automatic ex-

change, which was practically finished, and the magneto system rendering service to the city. The automatic system was ordered for the second time soon after. In Christiania, the capital of Norway, Western Electric systems have been used since telephony first was introduced in Norway. The exchange now in operation is the third one.

For the past five years the Norwegian government has made extensive investigations to determine on a suitable solution of the reconstruction of the Christiania telephone area. A commission of three administration officials appointed to decide on the proper method of operation, after a thorough study of available systems which brought the commission to this country, concluded that full automatic operation would be preferable. After due consideration the House of Parliament approved the commission's recommendations and voted some 11,000,000 kroner required for the reconstruction. Final tenders were called for in the Fall of 1914, both from the Western Electric Company and competitors. The tenders were compared by an expert committee of engineers consisting of Mr. Abild, chief engineer, and Mr. Engstet, administrative chief of the Norwegian Telegraph Administration, and Messrs. Iversen, Johannsen and Hultman, directors of telephones in Christiania, Copenhagen and Stockholm respectively. Besides there were as advisory members, Mr. Christensen of the Copenhagen Telephone Company and Mr. Kristiansen of the Christiania Telephone Company.

This able committee selected the Western Electric system and in so doing paid a tribute to its high quality and efficiency. The allied house in London was awarded contract for full automatic equipment for nine offices, with 30,100 lines and toll switching facilities, as well as 2,000 sub sets and 35,000 dials.

In Finland, telephone conditions are somewhat similar to those of United States, in that both the local and long distance systems are operated by private companies. Most of the larger towns have common battery equipments and the service rendered throughout the country is good. It is interesting to find that full automatic operation in many places in Finland is being met with favor, due to the prevailing condition of three more or less official languages being used, viz.: Russian, Finish and Swedish. With the larger plants it has become somewhat of a problem to keep up an operating force proficient in these languages, and it is obvious that the full automatic operation would largely solve the question.

## The Dallas Franchise

The franchise for the Dallas (Texas) Automatic Telephone Company, also providing for a merger of the Automatic Company and the Southwestern Telegraph and Telephone Company, was passed by the Board of City Commissioners for submission at the city election April 3.

The franchise as finally passed included changes agreed upon at the public hearing, these modifications having been made by City Attorney C. F. O'Donnell.

J. C. Casler, president of the Dallas Automatic Telephone Company, said that he did not consider it will be necessary to conduct a campaign for the franchise, objections voiced at the public hearings by citizens and by the commissioners have been met. Mayor Henry D. Lindsley has made no statement regarding his attitude on the telephone grant, but it is understood he is in favor of the franchise.

Murphy Townsend, representing Dallas cotton men, who are large users of long-distance service, told the Commission that the revised franchise met the suggested changes desired by his clients and that he believed it a good franchise.

While a tentative valuation of approximately $2,600,000 is placed on the Automatic Company's property, this valuation is subject to change on the part of the City Commission. A period of ninety days is allowed the city to fix this valuation finally, and if the valuation is not determined within that period the franchise becomes null and void. If a petition is presented for a referendum on the valuation within two months after the valuation is fixed by the commission, an election must be held on the question. The telephone company also will have the right to pass on the valuation and may reject it.

If a merger of the Automatic and Southwestern Companies is not consummated within eighteen months after the franchise is adopted, the merger provisions become void. The merger must be submitted to the people at a general election. In addition to voting on the question of permitting a merger, three other important matters will be referred to the people in regard to the merged company, namely, the rate of return, the maximum rates for service and the valuation. The franchise specifically provides there shall be no raise in rates for two years after consolidation, no matter what the losses may be.

The franchise as applied to the Automatic Company, is an indeterminate service at cost grant. A limitation on the service at cost plan exists in the provision that no increases in rates must be made for eleven years, or until the present franchise held by the company will have expired, and that the gross receipts tax must be paid during the period.

## Urges Changes in Minnesota Laws

J. W. Howatt, state supervisor of telephones, under the Minnesota Railroad and Warehouse Commission, in his second annual report, just issued, recommends amendments to the present law regulating telephone companies.

He says the law relating to the transfer of such companies should be amended so that the selling party would be required to join in the application filed with the commission by the purchasing party.

By having both parties join in such applications the work of obtaining the necessary information would be greatly facilitated and would enable the commission to render more correct decisions in such matters, he says.

Mr. Howatt also complains the present law does not provide any penalty for noncompliance with the orders of the commission. He recommends a penalty be provided for failure to comply with the statute and orders of the commission to make enforcement easier.

The report shows 1,735 telephone companies operating in Minnesota, of which the commission has a record. Mr. Howatt says there are doubtless many others.

## Consolidated Absorbs Rivals

The Consolidated Telephone Company of Pennsylvania, with lines reaching from Allentown to Easton and Philadelphia and north into New York State, has acquired the Easton and Bethlehem Consolidated Telephone Company and the Easton Telephone Company with several thousand subscribers. The investment is several hundred thousand dollars.

# Supervising for Courtesy

*A Talk to the Supervisors and Senior Operators of the Bell Company at St. Louis*

BY CHARLES M. MANTOR

THE work of the supervisor is too broad a subject to be attempted as a whole within the necessary limits of a single discussion. The theme of service, in supervising as well as in operating, may well be treated under the three headings of speed, accuracy and courtesy. Without doubt, supervision takes in how to direct the work of the operators (1) in acquiring speed, (2) in securing accuracy, and (3) in being courteous. The two first elements of supervision in service are always before us. Without constant attention to their development and maintenance, the service in any office would be disrupted. Their requirements are forcibly thrust upon the supervising force and cannot be avoided. Without speed, the ordinary traffic load would swamp the force and paralyze the service. Without accuracy, the speed would be correspondingly affected, and the storm of curses and complaints let loose by the suffering public would soon force strong, corrective measures to be adopted. So I shall try to avoid, in so far as possible, any reference to these two phases of supervising and confine myself to the subject of the supervisor's work in connection with courtesy in service.

Unlike speed and accuracy, the decline in courtesy of service may be so subtle, so imperceptible and yet so harmful that, unless the most alert and painstaking supervision is maintained an office may suddenly find itself almost hopelessly gripped in the clutches of indifference and carelessness.

How, then, shall we direct our efforts so that courtesy in service may thrive and become extended among our forces?

They way courtesy is shown in operating is through the voice. The supervisor, therefore, who trains her ear to catch incorrect inflections, careless enunciation, displeasing qualities of voice, hasty repetition, impersonal or indifferent tones, abrupt or discourteous tendencies of utterance, will be in the position where she can begin to direct her force intelligently, at least.

It is said of the tyrant, Dionysius, that he had his dungeon, wherein he kept all malefactors and political prisoners, so constructed that its galleries and cells, hewn out of the solid rock, in their entirety, were a vast, exact counterpart of the human ear; and at the end of the narrowing corridor, where the tyrant lay hidden, every muttered word and whisper of the prisones could be distinctly heard.

Of course, this listening was of the base and ignoble kind, but put to the proper use, the operation of the sense of hearing, keenly developed, and the information gained thereby understandingly, helpfully and tactfully applied, is the field wherein the supervisor must especially train herself in order to succeed in directing and controlling the factor of curtesy in the service given by the operators under her care.

In dealing with the subject a little more explicitly, let us consider in detail some of the conditions pertaining to active supervision for courtesy.

We may group them, for this discussion, under:

I. Voice production.
II. Enunciation.
III. Inflection.
IV. Inspiration.

I. One of the first steps taken by a successful supervisor is to "size up" each of the operators in her division. She mentally classifies the personality and distinctive characteristics of each individual, and maps out her probable method of procedure in dealing with each one. There is another condition added to this study of the individual operator, namely, to note the kind of voice with which she speaks. This should include such items as:

*a.* Does she speak in a different pitch or key when she is operating from her natural tone when conversing with another operator?
*b.* Does she speak with a nasal tone?
*c.* Is her voice shrill or unpleasant?
*d.* Does she complain, habitually, of her throat being dry?
*e.* Is her voice husky, and does she lose time because of hoarseness?
*f.* Does she speak too loudly?
*g.* Does her voice carry well?
*h.* Is her voice flexible, or does she speak in a monotone?
*i.* When she repeats an order, do the subscribers usually O. K. it, and do they say, "Thank you," frequently?
*j.* Is she inclined to speak in a matter of fact tone of voice, or do her words indicate a gracious and courteous attitude toward her subscribers?

There are a multitude of possibilities in the voices of the operators under the direction of a supervisor, and in no single effort of a supervisor will she see the results of her teaching so quickly apparent as in the development of the voice.

The greatest tact, however, is required in approaching an operator regarding her voice, for if her self-esteem is wounded it will be difficult to make further progress with her development along all lines of her work.

Then great care should be taken not to lead an operator into thinking that her voice is in danger of breaking down, or that it is hopelessly deficient. On the contrary, operators should be assured that, by speaking in soft, distinctly uttered tones, with as much sweetness and pleasantness as possible, they can overcome all defects which are not of an organic nature, and obtain for themselves as "smiling" voices as possessed by anyone.

A supervisor should consult her chief operator in matters where the voice quality or production of any of her operators is concerned.

II. Enunciation deals with the *physical* fitness and skill of the organs of speech (the lips, tongue, movement of jaws and vocal membranes) of the individual in producing words and numbers.

The supervisor first should become so familiar with the fundamentals of enunciated sounds through her own individual efforts and study, that her ear will be alert to catch an improperly spoken word or number uttered by anyone within her hearing. She will detect the operator who says, "Oprator?" "Waitin'," "M'ringin' 'em," "Nummer, plis?" "Time? Certny. Sevno'clock," etc.

In the second place, the supervisor should be conspicuous for her personal exactness and purity of enunciation, so that, aside from any suggestions or helpful criticisms she may find it necessary to give to individuals of her division, her own way of speaking is constantly serving as a shining example to her force.

Together with the ear, which notices things, and the exemplary enunciation, comes the tactful correction of careless enunciation among her operators. Positive meth-

ods of procedure cannot be laid down for this part of the supervisor's work. Among possible ways are:

*a.* By saying to each one of her division, "Let us see how perfectly we can speak our numbers and phrases today?"

*b.* By noting on a memorandum incorrect enunciation of certain words or numbers, and, during a meeting with her force, while going over the matter of enunciation, have the operators repeat phrases containing the words noted, gradually improve their enunciation without causing any one operator to realize that she is being especially criticized for faulty work.

*c.* By asking an operator to illustrate how she thinks a certain word or number should be pronounced, specifying the word or number that was mispronounced or poorly enunciated.

*d.* By holding short drills in enunciating vowel and consonant sounds, office names and numbers, with as many of the operators of her division as she can gather together for periods of three to five minutes.

*e.* By inciting her operators to lead the office in clean cut, distinct and pleasant enunciation.

III. Inflection pertains to those subtle glides and cadences of the voice that reflect the mental conception of the speaker as to the meaning conveyed by the words being spoken. In supervising for this characteristic of voice expression, the supervisor should be governed largely by the same methods outlined previously for "Enunciation." The ear of the supervisor again is called upon to detect irregular, senseless, or indifferent modes of utterance among her operators. She, herself, must have control of her voice inflections, and should use them as a criterion for her force to follow. In the voice drills, or when working on enunciation, the proper inflections may be considered at the same time with the enunciation. A word of warning here, however; the supervisor should not attempt to force an operator into using an inflection which she cannot give naturally. So long as the phrase, as spoken by the operator, is natural, sensible and courteous, and does not conflict with the inflections prescribed in the rules, such as the rising inflection after saying, "Number, please?" the inflection as given by the operator should be allowed to remain unchanged. If the inflection is decidedly wrong, and, after explaining the conditions leading up to and causing the speaking of the authorized phrase, the operator cannot then govern her inflection, she should be tried on other simpler phrases, until the control of the glides of the voice is secured. Such cases should also be reported to the chief operator should the progress still be unsatisfactory.

IV. Inspiration in voice expression, and especially in the expression of courtesy, is that breathing into the words uttered the actual spirit of courtesy, of the desire to please, of graciousness, that vibrates through the cadences of the voice and awakens a like response in the heart of the hearer. This cannot be taught by repetition in classes; it cannot be drilled into the individual operator by explanations and illustrations. It is an offspring of the *esprit de corps* that moves a well organized division of operators to work as a unit—the team work of spirits. It is fostered by the qualities of leadership possessed by the supervisor, who through her personal enthusiasm and exemplary conduct in her manner of speaking to subscribers, inspires in her operators a flaming desire to do likewise.

When the voice of an operator is lifeless and meaningless, look well to her work, for she has lost interest for some reason or other. If an operator is heard slurring her words and mumbling her numbers, watch out for inaccurate service, for she is not in harmony with her work. Where the supervisor hears any such voices, which are plainly out of harmony with true courtesy, she should warn her that her personal co-operation and help are needed and that right soon. And in the very efforts that are put forth by the supervisor to quicken or strengthen or soothe the spirit of the operator who by the tone of her voice has indicated that she is playing out of tune in the great symphony of service, in these efforts will be found the key to uniformly dependable and satisfactory telephone service; and those ills of indifference, carelessness, and lack of courtesy will never have a chance to get out of quarantine.

Summing it all up, in supervising for courtesy the supervisor is called upon to train her sense of hearing to the degree that her ear is keen to catch, in the busy hour of the office, the trend of the service that is being given as indicated by the voices of her operators. Further, the supervisor, if she wants to be a credit to her profession, is in duty bound to strive for that personal development of body, mind and spirit which is shown by the facility with which she speaks, by the meaning she puts into her words through the inflections of her voice, and by the spirit of courtesy with which she treats alike her operators and her subscribers, so that she may, in turn, induce, in the acts and lives of the operators under her direction, a corresponding degree of efficiency and proficiency in enunciation, inflection and courteous attention.

## Report Proves Chicago Bureau Useful

A saving of $49,146.50 to the telephone users of Chicago by one month's work of the telephone bureau was shown by figures submitted to the finance committee of the city council by John Garner, commissioner of public service.

The figures were submitted by Mr. Garner in support of his contention that his department should be allowed to conduct the revaluation of the telephone properties which will fix the new rates, and which he has offered to do for $75,000 less than the special experts who have heretofore made a good thing from city employment.

The figures submitted to the finance committee showed that by its system of "check up calls" the telephone bureau had decreased the average time of answering from 5.28 seconds to 4.64 seconds, within one month, resulting in a saving of 591.25 hours to the 450,000 subscribers.

"The city council did not even give the men in my department enough of an appropriation to hire a stenographer to write out these figures," Mr. Garner said.

"The men in the department are underpaid, and many of them are working for the city at a sacrifice, and yet, in one month's work the telephone bureau saved the city half of the total expense of the department. If the telephone bureau had been adequately appropriated for, it could have affected a much greater service."

## Bill for Call Registers in Massachusetts

A bill to require telephone companies to supply, free of charge, a register for recording the number of calls with each speaking instrument which is paid for according to the so-called "limited service" system was substituted by the Massachusetts House of Representatives for an adverse report of the Committee on Mercantile Affairs.

## Ohio State Shows Gain

Ohio State Telephone Company's report, just issued for February, shows these comparisons with a year ago: Revenue $321,740.28, year ago $290,580.37; expenses, including taxes and insurance, $187,119.71, year ago $165,536.69; net earnings $84,302.17, year ago $78,559.08.

# Skin-Effect Resistance Measurements

## *Conductors at Radio-Frequencies Up to 100,000 Cycles Per Second*

BY A. E. KENNELLY AND H. A. AFFEL

*The research here reported was conducted in the Research Division, of the Electrical Engineering Department of the Massachusetts Institute of Technology, during 1915-16, under an appropriation from the American Telephone and Telegraph Company. The object of the research was to obtain experimental data on the alternating-current resistances of various electrical conductors at frequencies up to 100,000 cycles. Presented as the Presidential Address before The Institute of Radio Engineers, New York.*

PUBLICATIONS of skin-effect measurements at high frequencies are very rare. The bibliography contains references to the work of Fleming, Lindemann, Dolezalek and others, in this direction. Fleming's measurements were published in 1910, and he was able to obtain confirmation of Kelvin's formula for the skin-effect resistance ratio of certain straight wires using oscillatory currents. The measurements here reported seem to differ from those previously published, in that they have been obtained with steadily sustained alternating currents, furnished by an a. c. generator, and using a null method, with a somewhat sensitive induction bridge. The research constitutes a continuation, at higher frequencies, of that reported in the A. I. E. E. 1915 paper.

In that paper it was reported that the standard skin-effect formulas for round wires had been observed to hold, within the limits of experimental error, up to 5,000∞, the highest frequency used. It was also noted that the skin-effect resistance ratio of conductors formed of 7 round bare strands, with normal spirality, was slightly greater than that of the equisectional solid wire. Straight flat-strip conductors were found to have a skin-effect resistance ratio far in excess of that predicated from existing available formulas.

The ratio $Z/R$ of the linear a. c. internal impedance of a conductor ($Z$ ohms $\angle$ per centimeter), to the linear d. c. resistance ($R$ ohms per centimeter), is a complex numeric called the *skin-effect impedance ratio.*[1] Its real component $R'/R$, is called the *skin-effect resistance ratio,* and is the usual factor which expresses the magnitude of skin-effect. The imaginary component $X/R$, is similarly called the *skin-effect reactance ratio.* This paper deals almost exclusively with the skin-effect resistance ratio $R'/R$. When subdivided wires are cabled, they are spiralled for mechanical reasons. This usually increases the resistance ratio, owing to what is called the *spirality effect.* When wires carrying alternating currents are placed in such a degree of proximity as to affect appreciably the distribution of alternating-current density over their cross section, owing to their mutually interacting magnetic fields, the resistance ratio $R'/R$ is ordinarily increased, owing to *proximity effect.* The ordinary skin-effect resistance ratio of a long straight conductor is therefore to be understood as occasioned by the distortion of alternating-current density over its cross section, due entirely to the magnetic field of that conductor. This research has been directed to the measurement of the resistance ratio in straight conductors only, in view of the fundamental character of such measurements, and the sparsity of published observations in this field.

### GENERATING APPARATUS.

The source of the alternating currents used in all the tests was an Alexanderson radio-frequency[2] alternator made by the General Electric Company, and loaned by the National Electric Signaling Company and Professor R. A. Fessenden. The direct-current driving motor is a 4-pole 125-volt 82-ampere machine, operating, when at full speed, at 2,000 r. p. m., and driving the alternator through a 10:1 step-up gearing, at a speed of 20,000 r. p. m. The alternator, of the inductor type, has a steel disk rotor with 300 radial slots. The stationary armature windings are supported on polar projections, on each side of the rotor, so that there is one complete cycle of induced e. m. f. in the armature winding at the passage of each tooth on the rotor. The full-speed frequency is therefore 20,000×300=6,000,000 cycles per minute, or 100,000 cycles per second. The alternator is so designed that the clearance between the rotor and the stator pole faces can be closely adjusted. With a small air gap, power up to 2 kilowatts, at about 15 amperes and 130 volts, can be obtained. In the tests described, the current taken from the machine rarely exceeded 5 amperes, thus enabling a less troublesome mechanical clearance adjustment to be used. The machine, which is self-oiling by forced lubrication, could be run at constant full speed for an hour or more without particular attention.

The wave form of the general e. m. f. was not investigated, but no evidence has presented itself of any appreciable irregularities, to which moreover the additional reactance automatically developed would be enormous.

The generator set was placed in a room about 20 meters away from the testing laboratory, and controlled from the latter, through a set of armature and field resistances. A calibrated little magneto generator, geared to the motor shaft, but not shown in the picture, actuates a calibrated d. c. voltmeter on the testing table, so as to indicate continuously both speed and frequency.

### METHODS OF MEASUREMENT.

The first means for measurement tried consisted of a simple Ohm's Law circuit, illustrated in Figure 1, using a hot-wire voltmeter $V$, and ammeter $A$. A series circuit was made up, comprising the alternator $G$, a hot-wire ammeter $A$, the test conductor $X$, and the adjustable condenser $C$. This condenser was needed in measuring the resistance of the test-wire $X$, in order to compensate for the relatively high reactance, that even a simple grid distribution of a few meters of test conductor will offer at so high a frequency. The operation consists in causing the radio-frequency current to flow in the circuit, and so adjusting the variable condenser $C$, that the minimum e. m. f. is indicated by the hot-wire voltmeter $V$, connected as shown. Under these circumstances, the ratio $E/I$ of the branch circuit $a\ b\ c$, will be the effective a. c. resistance of the test conductor and condenser, the latter being relatively small.

[1] The Angle sign $\angle$ indicates a complex quantity or "plane vector."

[2] Radio frequencies are, for convenience, arbitrarily chosen as those over 10,000 cycles per second.

The method has the advantages of simplicity and directness of measurement. It is swift and convenient. It has the disadvantages that it is not a null method, and that the final resonance adjustment is very troublesome; also, that at least two ranges of voltmeter reading are required, in order to complete the adjustment. At resonance; i. e., when the inductive reactance of the branch circuit *a b c*, is equal and opposite to the reactance of the condenser *C*, the current through the ammeter *A* is relatively large; while the e. m. f. indicated on the voltmeter *V* is relatively small. The capacitance *C* is such that for low-resistance test wires, at frequencies not exceeding 100,000∞, an air condenser cannot be used, and hence the apparent resistance of the test wire is increased, owing to the presence of power loss in condensers with solid dielectrics. For these reasons, the method was later discarded, in favor of an inductive-bridge method; but it is nevertheless recommended as a suitable method in commencing the study of high-frequency resistances; besides serving as a convenient check upon such null methods as may later be employed.

The test wires employed had apparent radio-frequency resistances of less than half an ohm. The condenser *C* was adjustable up to a maximum of 26 $\mu$ f. (microfarads), by steps of 0.001 $\mu$ f., and a final adjustment, with the aid of a little rotary oil-condenser, continuously variable to a total of about 4 m $\mu$ f. (millimicrofarads).

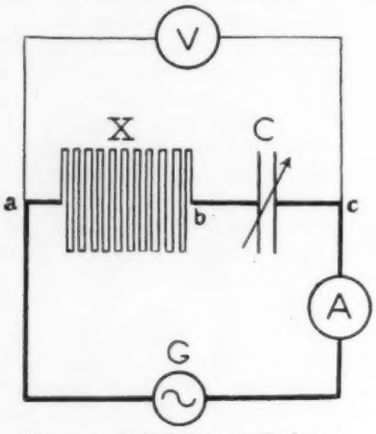


*Figure 1—Radio-Frequency Resistance Measurement by Ohm's Law Circuit*

There were two multiple-scale Hartmann and Braun voltmeters available, covering a range from 0 to 200 volts, and a multiple-scale ammeter, covering a total range from 0 to 5 amperes without shunt. Although calibrated with continuous currents, the design and construction of these instruments warrants the belief that their calibration is substantially correct for alternating currents over the range of frequency employed.

## INDUCTIVE BRIDGE METHOD.

The bridge method later employed corresponds, in essential features, to that described by A. Hund in 1915. The diagrammatic connections are indicated in Figure 2. *A* is the radio-frequency alternator, and *X* is the conductor under test. It is balanced, as to resistance and inductance, by the adjustable resistor *R*, and the adjustable inductor *L*. The equal arms of the bridge are the two opposing primary coils $T_1$ and $T_2$ of a small special testing transformer, the secondary winding $T_0$ of which is connected to the detector *D*. When zero balance is obtained in the detector *D*, for any measured impressed frequency within the range of the alternator *A*, the values of *R* and *L* are respectively the apparent resistance and inductance of the test conductor *X*, corresponding to that frequency.

## CONDUCTORS TESTED.

*Straight Solid Wires.*—A round solid annealed copper wire number 12 A. W. G. (diameter 0.205 cm. = 0.0808 inch) was tested by both of the above methods.

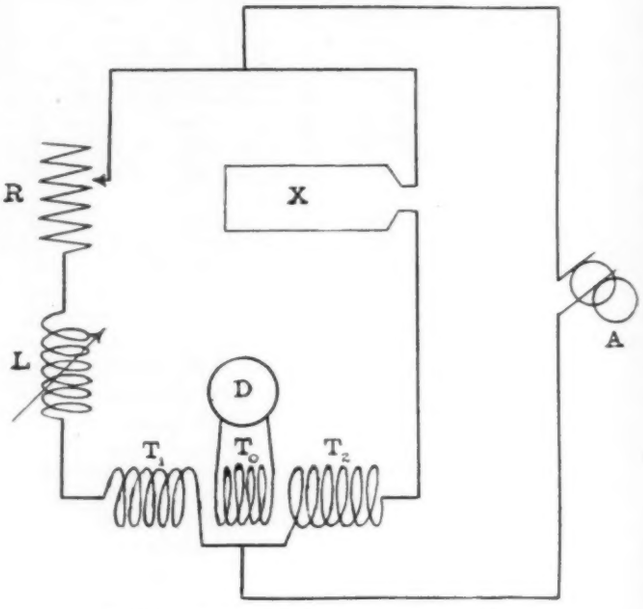


*Figure 2—Differential Transformer Bridge System.*

The results are given in Figure 3. The curve is the locus of the skin-effect resistance ratio $R'/R$, as computed from the real part of the Bessel-function formula:

$$\frac{Z}{R} = \frac{a_0 X}{2} \cdot \frac{J_0(a_0 X)}{J_1(a_0 X)} \quad \text{numeric} \angle \quad (1)$$

where *Z* is the internal linear impedance of the wire, of

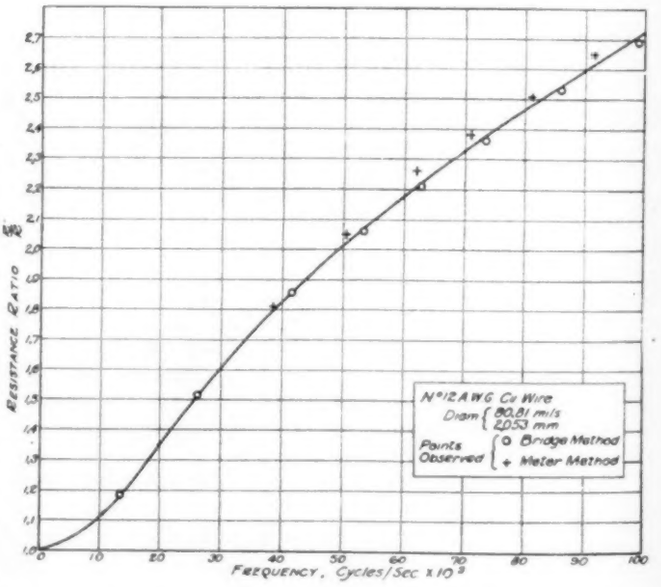


*Figure 3—Skin Effect Ratio for Number 12 A. W. G. Copper Wire as Observed and Computed.*

which $R'$ is the linear resistance component, $X$ is the radius of the wire in centimeters, and $a_0 = \sqrt{-j\,4\pi\gamma\mu\omega}$. The crosses represent observations by the Ohm's law method, and the circles by different method. It will be seen that the latter observations are in substantial accordance with the computed curve. The wire was mounted over insulators, on a flat frame illustrated in Figure 4, which was made standard in these tests. The advantage of this particular mounting is that it holds the

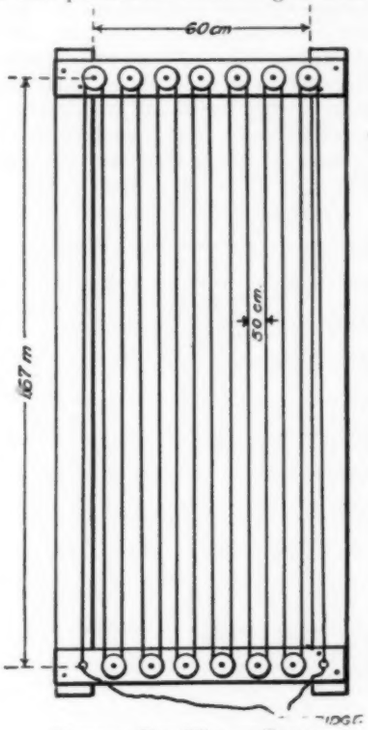


*Figure 4—Test Wire on Frame.*

wires in one plane at a uniform spacing (about 5 cm. or 2 inches), sufficiently great to make the proximity effect negligibly small. The external inductance of the wire, thus mounted, is also relatively small. It was ascertained that altering the spacing of the conductor on the frame, even to the extent of placing the 25 meters of wire in a single horizontal loop, 20 centimeters wide, on the wall, did not appreciably affect the skin-effect resistance ratio $R'/R$, to the degree of precision used in these tests. The mounting of the test wire on such a frame has the additional advantage that it brings the wire into a small compass, and minimizes its external electromagnetic disturbing fields on the measuring apparatus. Moreover, it enables a framed test wire to be kept indefinitely for reference, when desired.

A second test wire, formed of 25.3 meters of number 14 A. W. G. solid round copper wire (diameter 1.625 mm. = 0.064 inch) was tested by differential bridge at 22° C., at a later period, and with greater precision. Its linear resistance was found to be 0.00825 ohm per meter. The skin-effect resistance ratio of this wire was found to agree with the value computed from the standard formula, within the limits of observational error, the following results being obtained:

| *Frequency Cycle/second* | *Skin-effect Resistance Observed* | *Ratio $R'/R$ Computed* | *Ratio Observed Computed* |
|---|---|---|---|
| 96,100 | 2.192 | 2.189 | 1.002 |
| 82,200 | 2.051 | 2.049 | 1.001 |
| 59,300 | 1.775 | 1.774 | 1.001 |
| 38,000 | 1.453 | 1.458 | 0.997 |
| 20,000 | 1.162 | 1.170 | 0.993 |

The entire series of observations are presented by the circles in Figure 5, the curve showing the Bessel-function computed values, according to formula (1). It will be seen that there is a satisfactory agreement between the observations and this curve. Although no reason can perhaps be assigned why the skin-effect resistance ratio of a round wire should depart, at greater frequencies, from the theoretical formula, already found to hold up to 5000∞, yet it is satisfying to find the agreement maintained. It should be noted that when attempts are made to measure with precision the skin-effect resistance ratio of such a straight round wire, the temperature of the wire must be carefully noted.*

STRANDED WIRES.

*Stranded Copper Wires.*—After ascertaining that round solid copper wires, at radio frequencies, conformed to standard formulas, measurements were extended to subdivided or stranded copper wires with insulated strands. A test was made of stranded wire, of 20 strands, each number 26 A. W. G. (0.405 mm.) and enamel insulated to a diameter of 0.42 millimeter. The strands had a usual amount of spiralling or lay (4 cm. pitch). The unbraided diameter, i. e., the diameter of the bundle of strands, under the braiding, was about 25 per cent greater than that of an equisectional solid or unstranded wire. The skin-effect resistance ratio, $R'/R$, for this stranded wire, between 50,000∞ and 100,000∞ was about 10 per cent less than that computed for the equisectional solid wire.

Another stranded wire had 50 strands of number 28 A. W. G. copper wire (0.32 mm., silk covered to 0.45 mm.) the strands being made up with a very long lay (about 1 turn per meter) and covered with braiding. The unbraided diameter was about 80 per cent greater than that of the equisectional solid wire. This conductor had a skin-effect resistance ratio, at 100,000∞, about 33 per cent less than that computed for the equisectional solid wire. Since measurements of the skin-effect resistance ratio of seven-strand copper cables, last year, showed a slight increase over the equisectional solid con-

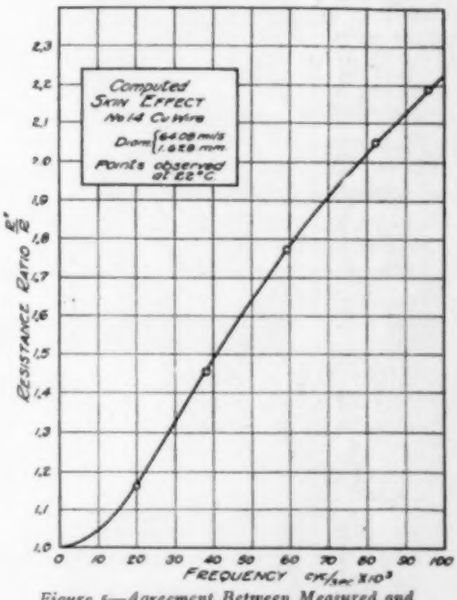


*Figure 5—Agreement Between Measured and Computed Skin-Effect Ratios for Round Wire.*

* The result is also in conformity with that obtained by Fleming, through another method, to frequencies up to 900,000—. See Bibliography Number 3.

ductor, at frequencies up to 5,000∞, as stated in the above-mentioned A. I. E. E. paper of August, 1915, it seemed desirable to separate the effects of subdivision through insulation, from those of spirality. By the courtesy of the Simplex Wire and Cable Company of Boston, we were able to secure a sample of 25 meters of a stranded and braided wire, containing 48 strands, each of number 30 A. W. G. copper wire, diameter 0.255 millimeter, silk insulated to about 0.33 millimeter. These strands were braided up without twist, by being carefully drawn through a die, whipped with silk thread by hand, and then laid on the supporting wooden frame for testing. By this treatment, it was hoped and believed that each individual strand would preserve its proper position substantially unchanged in the cross-section throughout the sample. The over-all unbraided diameter was about 50 per cent greater than that of the equisectional solid wire. Another sample of stranded wire was made up at the same time, except that it had the usual amount of spirality, i. e., 1 turn in 4 centimeters about the central axis, and was machine braided.

Figure 6 shows the results of the skin-effect measurements on these two stranded conductors, and gives the resistance ratio $R'/R$ against impressed frequency up to 100,000∞. The curve $A$ refers to the stranded untwisted sample, $B$ to the stranded twisted sample, and $C$ to the computed solid equisectional conductor. It will be seen that the subdivision of the wire into separate parallel untwisted strands, with this amount of silk separation, reduced the resistance ratio, at 100,000∞, from 2.38 to 1.86; but that the spirality effect of the lay in sample $B$, brought the ratio nearly half way back, or to 2.11. The $B$ curve lies roughly midway between the $A$ and $C$ curves throughout. The reasons for the greater skin effect on the $B$ sample over that of the $A$ sample are probably twofold; namely (1), the additional copper losses in $B$ due to the spirality effect; i. e., the longi-

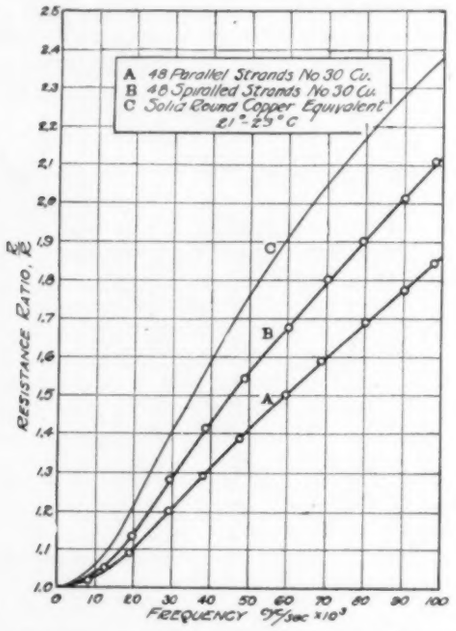
A 48 Parallel Strands No 30 Cu.
B 48 Spiralled Strands No 30 Cu.
C Solid Round Copper Equivalent
21°-25° C
RESISTANCE RATIO, R'/R
FREQUENCY ~/Sec x10³

*Figure 6—Effects of Stranding with Insulated Strands.*

tudinal component of alternating magnetic field in the interior of the wire $B$, due to the action of the lay as a solenoid, and (2) the greater tightness under the braiding of the spiralled $B$ sample, than that which could be safely given to the unspiralled $A$ sample by hand, with a corresponding diameter enlargement ratio of only 1.4 for $B$, as against 1.5 for $A$.

If there were no insulation separating the individual parallel strands in the $A$ sample, then it is believed that the skin-effect resistance ratio would rise into coincidence with $C$, or would become the same as in the equisectional solid wire. In other words, the theory and tests, to date, of skin effect in round wires, seem to show that the mere subdivision of the wire into a round bundle of parallel round filaments, which make contact with each other, but entrain channeled air spaces, has no appreciable effect on the skin-effect ratio; because the magnetic flux maintains a cylindrical distribution. When, however, even a thin layer of insulation separates the individual strands, some magnetic flux circulates radially to the mass, around each strand, and diminishes the skin-effect resistance ratio of the whole, while raising somewhat the skin-effect reactance ratio of the whole.

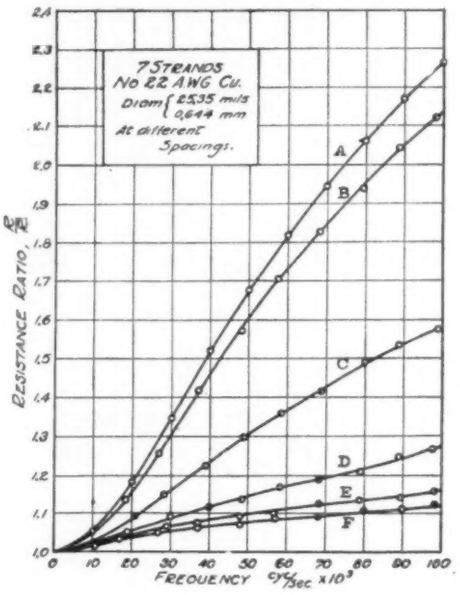


*Figure 7—Wire Spacing.*

*Measurements with Definitely Spaced Strands.*—In order to study, in greater detail, the effect of separating the strands of an unspiralled stranded conductor, a test loop was constructed, about 10 meters long, of a copper conductor comprising 7 strands of number 22 A. W. G. wire (diameter 0.644 mm.). These strands were supported parallel to each other in air, at the positions they

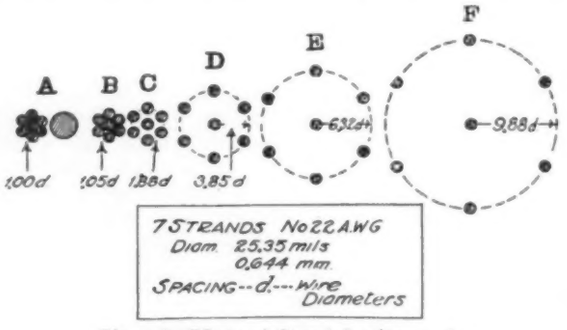


*Figure 8—Effects of Strand Spacing on the Skin Effect of a Stranded Conductor.*

would occupy in any 1-strand cable; i. e., one wire at the center, and the six others forming a hexagon about this, as indicated in Figure 7. The spacings were, however,

changed in the different tests, by means of specially prepared insulating frames, strung on the wires at suitable distances. In this way, the interaxial spacing distance could be varied from 1 strand diameter, to nearly 10 strand diameters, in 6 successive steps.

The results of the skin-effect resistance-ratio measurements in these successive geometrical arrangements are presented in the six curves of Figure 8. Curve *A* is for the 7 wires bound together in close parallel contact. It agrees with the computed resistance ratios of the equisectional solid conductor, within the limits of observational error. Curve *B* gives the corresponding ratios when all of the 7 wires were insulated with an enamel thickness of approximately 0.015 millimeter, thus increasing the interaxial spacing distance to 1.05 times the strand diameter. It will be seen that the ratio $R'/R$ has thus

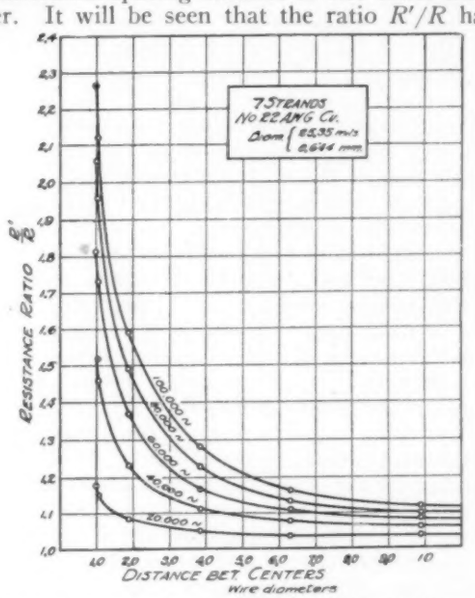


*Figure 9—Curves Showing Drop in Skin Effect with Increased Spacing Distance Between Strands of Conductor.*

lowered about 10 per cent, with respect to number 1, or the equisectional solid wire. The other curves, which will be self explanatory, show how rapidly the spacing distance diminishes the skin-effect resistance ratio. At 100,000∞, this ratio is only 1.12 for a spacing distance of 9.88 diameters, as against 2.26 for either the solid wire, or a spacing distance of 1.00 diameter. At great separating distances, it appears that the resistance ratio of the 7-strand conductor would substantially coincide with that of any one of its components.

First-approximation formulas have been worked out for dealing with the geometrical relations of such variable "strands," as are indicated in Figure 7. It thus far appears that these formulas represent the observed facts fairly well for the larger spacings, but give lower ratios than are measured at the smaller spacings; perhaps because there is extra skin effect in the component strands at close spacings, due to proximity effect, or current-density distortion due to the magnetic fields of neighboring strands.

The approximate proportionally maintained between the curves in Figure 8 permits of using suitable approximate reduction factors for all frequencies between 40,000 and 100,000∞. This relation is presented more clearly in Figures 9 and 10. The upper curves of Figure 9 here approach simple hyperbolas; so that doubling the spacing distance approximately halves the extra resistance of skin effect.

*Very Finely Stranded Wire.*—Two 10-meter samples of highly subdivided wire, with enamel-insulated strands, were obtained through the courtesy of Dr. A. N. Goldsmith of New York. The first (Figure 11) contained 169 wires, arranged in 13 twisted bundles, each of 13 twisted strands, of number 40 A. W. G. diameter 0.080 millimeter, enamelled to about 0.085 millimeter. The total diameter over all wires, and under the braiding, was approximately 1.47 millimeters, representing a diameter enlargement ratio of about 1.4 with respect to the equisectional solid copper wire. It is obviously difficult to remove the enamel successfully from all of these little wires, and to solder them together into a common terminal with the certainty that none have failed to make good electrical contact therewith. Moreover, it would be very difficult to make sure that each of the individual

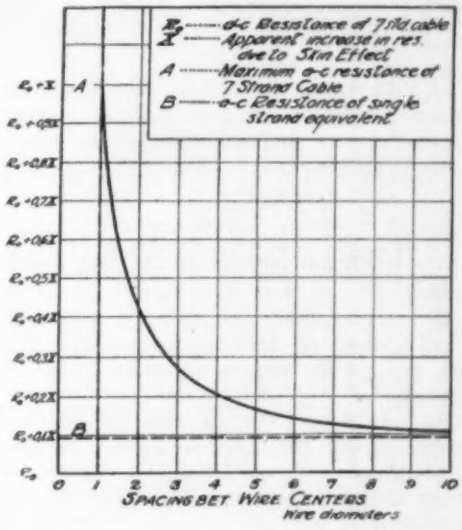
R₀ ------ d-c Resistance of 7 Std cable
X ------ Apparent increase in res. due to Skin Effect
A ------ Maximum a-c resistance of 7 Strand Cable
B ------ a-c Resistance of single strand equivalent
A
B
SPACING BET WIRE CENTERS
Wire diameters

*Figure 10—Average Decrease in Skin Effect of 7-Strand. Cable with Increased Wire Spacing.*

insulated strands is intact, without discontinuity, throughout the test piece. In fact, the linear resistance of the sample was observed to be 0.0221 ohm per meter at 20° C.; whereas, without allowance for spirals, the computed linear resistance was 0.0204 ohm per meter, if all the wires were active, indicating a conductance defect from all causes of 8.4 per cent. However, treating the sample as a stranded wire of, say, 162 strands, having this observed linear resistance, the measured skin-effect resistance-ratio curve is given in Figure 11. It will be observed that, at 100,000∞, the ratio, $R'/R$ is 1.17, and that the extra resistance of skin effect is roughly 60 per cent less than that computed for the round solid copper wire of equal d. c. linear resistance. The reduction may be attributed partly to the insulation separation of the strands, and partly to the transposition effects, since the twisting of the component strands in each bundle tends to interchange their relative positions in the cross-section of the whole.

The second sample was made up, in a similar manner, of 49 strands, each number 38 A. W. G. (0.1007 mm. enamelled), arranged in 7 bundles of 7 strands each. The observed linear resistance indicated that all of the 49 strands were probably intact and connected in parallel between the soldered extremities. The total cross-section of conductor is approximately 0.39 square millimeter. The unbraided diameter was 0.83 millimeter, representing a diameter enlargement ratio of about 1.5. The skin

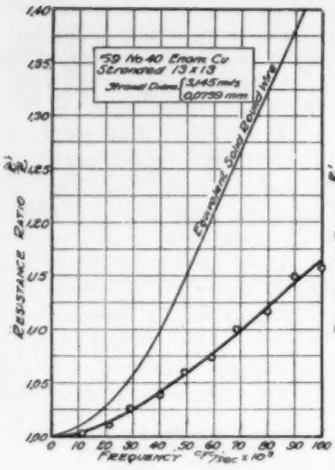
59 No 40 Enam. Cu
Stranded 13 x 13
Strand Diam. {3.445 mils / 0.0739 mm
Equivalent Solid Round Wire
Resistance Ratio
Frequency Cycles/sec x 10³

Fig. 11.

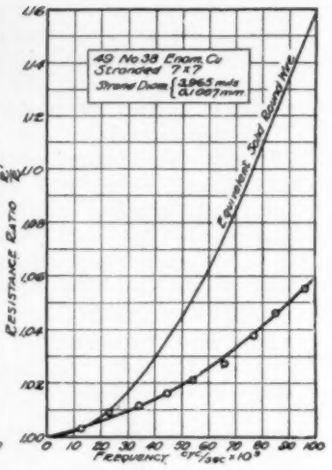
49 No 38 Enam. Cu
Stranded 7 x 7
Strand Diam. {3.965 mils / 0.1007 mm
Equivalent Solid Round Wire
Resistance Ratio
Frequency Cycles/sec x 10³

Fig. 12.

effect of this strand at various frequencies is shown in Figure 12, and is similar in regard to equivalent round wire to that shown in Figure 11 for the other and more finely subdivided stranded wire.

*(To be concluded.)*

## Michigan Municipal Bill Discussed

Attorney General Groesbeck of Michigan was compelled personally to defend his resolution empowering cities to own and operate telephone lines and systems, before the senate committee on constitutional amendments.

Opposing him were Thomas Bromley, of Muskegon, representing the United Home Telephone Company, of Muskegon, and W. G. Berry, commercial agent for and representing the Michigan State Telephone Company.

Although the committee had before it merely the proposition of submitting the question of municipal ownership of telephone lines to the people, the telephone men attacked the entire proposition, insisting that a city-owned telephone plant was an impracticability.

Mr. Bromley insisted that it would wreck, not so much the Bell system in the state, but the Independent system, and that if the city of Detroit took over the Bell lines, the disease of system-grabbing might become infectious and villages and municipalities, small and great, might do likewise.

"The result will be, in our section of the state, at least, that the service will be nothing at all," he said. "In our company we pride ourselves on the fact that we give what the people want and therefore we have no kicks made to the railroad commission. This commission represents the people, and this amendment to the constitution will make possible the taking away from the commission of the right to regulate rates, for the public will insist in some cases that it knows more about the telephone business than anybody else."

Mr. Berry attacked the Detroit end of the case severely and insisted that the proposition of municipal ownership of anything was a dangerous plan, for he said there have never been any good results from municipal ownership since it was put into the constitution of 1909.

"In this case, if it came to a vote on Detroit, the people who had really no interest in the matter would do the voting," he said. "Do not forget that its being a bonding plan, the women would be allowed to vote, and you would have a case where the people with the cooler judgment in such matters would be out-voted."

Mr. Groesbeck contended that he was fighting for the principle of municipal ownership of telephone companies, just as the cities were now given the right to own other public utilities.

"The history of the public ownership business in the state since it was adopted in the constitution of 1909," he said, "is one of conservatism. The people do not run wild nor become rampant with this power to own and operate, or to purchase and condemn public utilities by their own vote. Twice the people have refused to vote the purchase of the transportation public utility because the price was too high. Certainly that shows that they are not likely to run mad over the matter. For my part, I have every confidence in the world in the people's judgment."

Mr. Berry argued with Groesbeck over the figures which had been brought out at the telephone meter hearings before the railroad commission and insisted that they showed conclusively that the city could not operate the lines and system.

"The telephone business is unlike any other public utility," he said, "and there can be no comparison with the others, such as Mr. Groesbeck makes. The giving of telephone service is a state proposition, a national proposition, and when the city of Detroit buys the plant within its boundaries, it blocks the system and only makes matters worse."

That there is going to be opposition to the plan of the attorney-general was evident. While the house committee reported the resolution out with a favorable recommendation, Representative Charles Flowers, a member of the committee, was authority for the statement that every one of the members of the committee would be against the measure when it came up on the floor of the house. Several senators, too, received telegrams from certain of their constituents asking that they vote against the resolution. One telegram received by Senator Harvey A. Penney, of Saginaw, from W. S. Linton, the head of the Chamber of Commerce of that city, would indicate that an attempt is being made to line up the various chambers and boards of commerce against the plan.

Senator George Scott, of Wayne, took a hand just long enough to ask Mr. Groesbeck a couple of questions which rather indicated how he, as a member of the Wayne crowd, was going to stand.

"Isn't this just a plan to hold something over the telephone company in the nature of a club?" he asked Mr. Groesbeck.

"No, not as a club. The passage of this resolution should be a stimulant for the telephone company to keep its service up to snuff because it would know that the public could demand good service."

"Well, I don't think anybody with sense would have the city of Detroit take over the telephone system, do you?" countered Scott.

"Yes, I do," emphatically answered the attorney-general.

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The American Telephone and Telegraph Company has decided to double the capital stock of the Western Electric Company, one of the subsidiaries, from $15,000,000 to $30,000,000, and a meeting has been called for April 3 to take action.

# Telephone Patents Issued Recently

*A Brief Digest of those Current Specifications Most Interesting to Telephone Men*

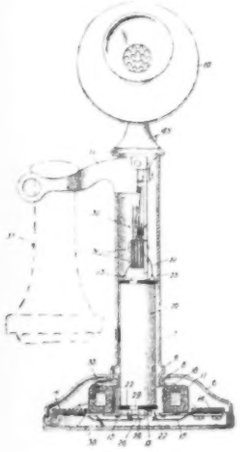
BY DAVID S. HULFISH

NO. 1,210,289. Busy Test System. Issued to Wm. Aitken, assignor to Relay Automatic Telephone Company, Ltd., London, England. Lamp signals are provided for the jacks of a group of trunks; the lamps glow only when a test key is depressed. In addition there is provided a group of overflow trunks, and the lamps of the overflow group glow when the primary-group trunks are all busy. The circuit is for manual switchboards only.

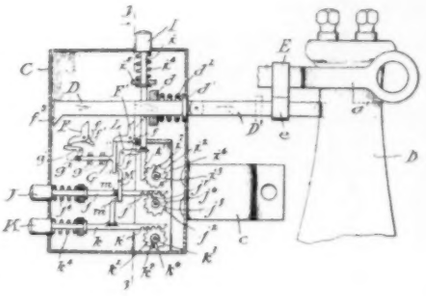
1,210,424. Telephone Desk Set. Issued to E. B. Craft, assignor to Western Electric Company, Inc., New York. An induction coil is mounted in the base of the desk stand; a condenser of the rolled type, and in cylindrical form, is mounted within the lower part of the stem of the desk stand, and the switch hook finds room above the condenser.

1,210,463. Call Recorder. Issued to R. H. Greenlaw, Lawrence, Mass. A mechanical registering device is mounted near the telephone hook and is so arranged that the receiver can not be hung upon the hook until after the registering device has been operated. Different buttons are provided, so that the call may be registered as "successful," or "busy," or "wrong number." The feature of importance is that, once the receiver has been removed from the hook, it can not be replaced until after a registration of some kind has been made.

1,210,499. Telephone Extension Station System. Issued to J. H. Levis, Jr., assignor to Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. When an extension station is called, a button is pressed to operate a relay to connect the extension telephone to the exchange line; the relay is held by the telephone hook while speaking, and is released when the telephone is hung up.



1,210,424.



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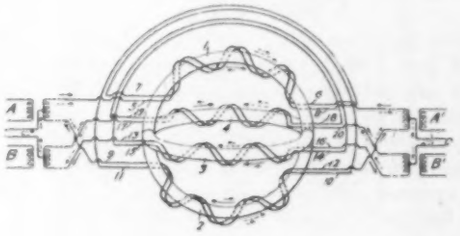

1,210,884.

1,211,607.

1,210,505. Selector System. Issued to A. E. Lundell, assignor to Western Electric Company, Inc., New York, N. Y. A button-bank type or adding-machine type of call sender is associated with the switches of an automatic telephone switchboard; the circuit arrangement is such that the automatic switch adjusts itself to the position indicated by the keys depressed upon the button bank.

1,210,602. Cord-Pair Circuit. Issued to H. P. Clausen, assignor to Western Electric Company, Inc., New York, N. Y. A novel arrangement of two card pairs by which three telephones may be connected together for tri-partie conversation.

1,210,603. Calling Device. Issued to H. P. Clausen, assignor to Western Electric Company, Inc., New York, N. Y. The pulldial has finger hooks instead of finger holes, and each hook is pivoted upon the rotatable dial disk so that the hook above the finger may swing out of the way of the finger operating upon the hook below.

1,210,604. Automatic System. Issued to E. E. Clement, assignor, to James R. Garfield, trustee, Cleveland, Ohio. In a system where an automatic switch picks up a calling line by two movements of selection, the switch makes its first movement only under control of an operator's key; after which the second movement is made automatically, and the operator then completes the connection by controlling all of the movements of a companion switch.

1,210,616. Busy-Test System. Issued to B. G. Dunham, assignor to Western Electric Company, Ltd., New York, N. Y. In an automatic telephone exchange, the busy test relay is self-locking and applies either ringing current to the selected line or busy-tone current to the calling line, according to whether it is locked up or not after testing the selected line.

1,210,617. Relay. Issued to B. G. Dunham, assignor to Western Electric Company, Inc., New York, N. Y. The retracting spring of the relay armature is arranged to exert a minimum retracting force when the relay is in its operated condition. The gravity armature of olden days used to do the same thing.

1,210,628. Loading Coil. Issued to Wm. Fondiller, assignor to Western Electric Company, Inc., New York, N. Y. The claims are written upon the arrangement of windings upon the core, and upon the proportion of mutual inductance between the windings in the different layers.

1,210,652. Trunking System. Issued to L. H. Johnson, assignor to Western Electric Company, Inc., New York, N. Y. When a call is trunked from the originating office to a second office and then is trunked farther to a third office, a circuit through the trunk enables the originating office to control a signal at the third office, where the called line is found.

1,210,653. Operator's Circuit. Issued to L. J. Johnson, assignor to Western Electric Company, Inc., New York, N. Y. The operator listens upon a cord pair by operating a relay. The operation of any one relay short-circuits all the remaining relays so that the operator can not listen upon more than one cord pair at one time.

1,210,884. Loading Coil for Phantom Circuit. Issued to J. F. Baldwin, Jr., assignor to Western Electric Company, Inc., New York, N. Y. The coil has two toroidal cores at right angles to each other upon a common diameter, and circuits of windings are so arranged as to load both limbs of the phantom circuit.

1,210,912. Selecting System for Automatic Exchange. Issued to A. F. Dixon, assignor to Western Electric Company, Inc., New York, N. Y. This system is applicable to an automatic switchboard in which the call sent by the subscriber's telephone is registered upon central office registers and then transmitted from the registers to the selective switches to be adjusted to select the desired line. An arrangement of polarized relays and commutators is positioned between the register and the selective switch to be adjusted.

1,210,917. Call Sender. Issued to A. H. Dyson, assignor to Kellogg Switchboard and Supply Company, Chicago, Ill. The signaling contacts of the call sender are normally shunted by other points, and the shunt is removed when the signaling dial is drawn out of normal position to adjust it for sending a number.

1,211,044. Trunk Signal System. Issued to H. M. Bas-

com, assignor to Western Electric Company, Inc., New York, N. Y. A trunk extends from the central office to a private branch exchange, and signal circuits are so arranged that, when the central office end of the trunk is disconnected after conversation, the line signal of the trunk will not be displayed again until after the private branch end of the trunk has been disconnected from the last call and again connected for a succeeding call.

1,211,434. Automatic Exchange System. Issued to C. L. Goodrun, assignor to Western Electric Company, Inc., New York, N. Y. In a system where the impulse from the call sender is short, a locking circuit is provided upon the central office magnet to insure time for the selective step.

1,211,607. Telephone Set. Issued to M. K. McGrath, assignor to Western Electric Company, Inc., New York, N. Y. The receiver is hung just over the call sender of the automatic telephone set, so that the call sender can not be operated until after the receiver has been removed from the hook.

1,211,688 and 1,211,289. Automatic Telephone Exchange System. Issued to F. W. Dunbar, assignor to Kellogg Switchboard and Supply Company, Chicago, Ill. (Applications filed November 12, 1904, and June 19, 1905.) Combinations of automatic exchanges and manual switchboards are shown and claimed. The claims in the two patents total one hundred and ninety.

1,212,492, 1,212,493 and 1,212,494. Manual Telephone Exchange System. Issued to L. H. Johnson, assignor to Western Electric Company, Inc., New York, N. Y. These three patents show three systems for accomplishing the same result, namely, that a relay shall connect the operator's telephone set to a cord circuit, with such interference between the relays of the switchboard that the operator cannot be connected to two-cord circuits at the same time.

1,212,495. Trunk System. Issued to L. H. Johnson, assignor to Western Electric Company, Inc., New York, N. Y. When an operator picks up a trunk circuit leading to a distant exchange, relays ring upon the trunk for a brief interval to signal the distant exchange; during the period of ringing the receiver of the telephone set at the distant exchange is short-circuited to avoid the annoyance of ringing into the operator's ear if she be on duty at that time.

1,212,728. Automatic System. Issued to W. P. Albert, assignor to James R. Garfield, trustee, Cleveland, Ohio. The patent covers an exchange which is a combination of automatic and semi-automatic or manually-assisted-automatic exchange. When a receiver is lifted, the line is connected to a manual switchboard unless the call sender be operated, in which case the automatic switches of the exchange are operated by the call sender and the manual switchboard connection is dispensed with.

1,212,755. Method of Making Induction Coils. Issued to Wm. Fondiller, assignor to Western Electric Company, Inc., New York, N. Y. The method of making an induction coil which comprises heating the core material to a baking temperature, assembling the core material into a core and placing windings upon the core, then heating the finished coil to the same temperature as first used upon the core material.

1,212,809. Selective Automatic System. Issued to F. N. Reeves and A. E. Lundell, assignors to Western Electric Company, Inc., New York, N. Y. A circuit arrangement for reducing the total number of relays used in the Western Electric machine telephone switching system.

1,212,908. Busy Test System. Issued to J. E. Cooley, assignor to Automatic Electric Company, Chicago, Ill. With the usual methods of switching with the Strowger type of switch, the final selector is restored to normal when a busy line is selected and tested. With the system of this patent, the final selector is positively released and becomes available for another connection immediately. The busy tone is returned from one of the earlier selectors used in the connection.

# Public Utility Commission News

*Reports Concerning the Activities of State Regulating Bodies in the Telephone Field*

## California

ACCUSING the San Diego Home Telephone Company of permitting irregularities in its tariffs in violation of the law, charges made by the former president of the corporation, Charles E. Sumner, are on file with the state railway commission. Accompanying the charges made in the name of the law firm of Sumner & May, is a request for an investigation of the affairs of the public service company by the commission.

It is charged, according to the railway commission's statement, that the telephone company has discriminated in favor of some parties, giving them telephone rental at a reduced figure from the usual charge, and entirely waiving in some cases the $3.50 installation charge fixed by the railway commission. The public utilities act of 1915 provides penalties against both the company and its officials for such discrimination, fixing a fine of not less than $500 or more than $2,000 against the corporation for each violation, and making the offending officials liable to a fine of $1,000 or one year's imprisonment in the county jail, or both the fine and imprisonment.

Manager Roy E. Thompson and Directors F. C. Avery, M. P. Snyder and T. G. Thompson deny that the company has in any way violated the law. The only reductions made, they say, are to employes or those approved by the railway commission rulings to be eligible to favors from the telephone company.

## Idaho

The utilities commission is making an effort to have the Long Valley Mutual Telephone Company establish its joint service with the Mountain States Telephone & Telegraph Company. The connection was recently severed at Cascade, because of poor service, so the Long Valley people told the commission. Since the break in the service it is impossible to call towns in the Long Valley country over the long distance telephone.

## Indiana

The Home Telephone and Telegraph Company, of Fort Wayne, was authorized by the Public Service Commission to issue $250,000 of common stock to retire bonded indebtedness and make further extensions of its property. The stock now outstanding totals $821,750 and the bonds $215,500, according to the order.

## Maine

The Newfield Telephone Company asked permission to issue common capital stock of the aggregate par value of one thousand dollars, at par, for organization of the corporation and acquisition of a telephone system.

The petitioner is a corporation organized under the general laws of the state relating to telephone corporations. It has no stock outstanding except qualifying shares for organization purposes, and has no other obligations. Those interested in its promotion are now among the persons associated together as owners and operators of the Newfield Telephone Company, an unincorporated association, and propose to take over, by purchase, the plant, franchises and business of that company.

The property thus to be acquired actually cost the

present owners something over seven hundred dollars, and is now in active use. The purchase price is to be seven hundred dollars. The organization expenses of the petitioning corporation will be about one hundred dollars. The balance of the money to be secured from the proposed sale of stock is to be used as working capital.

The commission orders that the Newfield Telephone Company be authorized to issue forty shares of its common capital stock, of the par value of twenty-five dollars per share, and of the aggregate par value of one thousand dollars, and to sell the same at not less than par. The proceeds of the sale of said stock shall be applied to the payment of the reasonable organization expenses of the corporation and to the purchase of the property, franchises and privileges of the Newfield Telephone Company now existing as an unincorporated association.

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The commission has ordered that J. B. Philbrick, doing business under the name and style of the Farmers' Telephone Line, be authorized to sell all of the property, rights and franchises of the said Farmers' Telephone Line to F. D. McAllister, doing business under the name and style of Andover Telephone Company; and that F. D. McAllister be authorized to purchase and acquire the same, and thereby become subject to all of the obligations of the Farmers' Telephone Line and of J. B. Philbrick to render service as a telephone company within the territory now served by it, within thirty days from February 27, 1917.

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## Massachusetts

The bill making appropriations for the maintenance of the State Public Service Commission is hung up between the Senate and House, and it is intimated that an attempt will be made to let the bill stay there for the sake of killing the appropriation of $15,000 for an investigation of the New England Telephone Company.

The House refused to concur in Senate amendments, and the Senate voted March 13 to ask for a committee conference.

If that committee fails to agree the bill will fail, and there will be no investigation of the telephone company. Incidentally, the Public Service Commission will have no money for its maintenance, but that defect can be remedied by another petition.

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## Michigan

An order was entered by the State Railway Commission at Lansing, authorizing an increase of $1,000 in the capital stock of the Newton-Leroy Telephone Company. The increase will allow other farmers in the southeastern part of the county to hold stocks in the community service system which was started in the county two years ago. The Newton-Leroy company gives direct service from all parts of the county to Sonoma, East Leroy, Joppa, Stanley, Pine Creek and Newton Center, and is given without toll charges.

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## Minnesota

The Application of the Northwestern Telephone Exchange Company to purchase from the Shakopee Telephone Company, the local exchanges located at Bloomington and Savage, Minnesota, was heard by the commission on December 19.

The Shakopee Telephone Company operates local telephone exchanges at Shakopee, Bloomington and Savage. It has quite an extensive rural line development in the vicinity of the latter exchanges. Bloomington is located approximately six miles south of the city limits of Minneapolis, and Savage is located approximately four miles southwest of Bloomington. Both points may reasonably be considered suburban to Minneapolis, and the testimony shows that the majority of the farmers in the vicinity of these places live on small plots of ground and dispose of their produce in Minneapolis.

At present there are at Bloomington two telephone exchanges, one operated by the Shakopee Telephone Company, which serves seven stations in the village and 168 rural subscribers in the vicinity. The other is operated by the Tri-State Telephone & Telegraph Company, and serves thirty-five stations, the majority of which are rural. At Savage there is but one exchange, operated by the Shakopee Telephone Company and serving approximately twenty-six local and forty-four rural stations. The rate charged for service by the Shakopee Company at both the Bloomington and Savage exchanges is $1.00 per month for all classes of service. Although the three companies named operate in the territory between Bloomington and Minneapolis, the Northwestern Company has not operated in competition with the Shakopee Company for business in that territory, but under an agreement whereby neither company will install service in the territory occupied by the other without the consent of the other. For this reason, the Northwestern Company has but six stations in the territory now served by the Shakopee Company. The testimony shows, however, that there has been considerable demand for Minneapolis service from the Northwestern Company from persons in this territory. The Bloomington and Savage exchanges have not been productive and the physical property has been permitted to deteriorate so that it is now in a run-down condition and considerable expenditure will be necessary to place the plant in condition to operate economically and give satisfactory service. The Shakopee Telephone Company cannot afford to make this expenditure. For this reason and because of the proximity of this territory to the city of Minneapolis, which will result in the majority of the farmers seeking direct service from the larger center, the Shakopee Telephone Company desires to dispose of the property.

The Northwestern Company proposes to extend its Minneapolis rural lines throughout the territory under consideration and as rapidly as the present subscribers desire Minneapolis service it will be furnished them at the Minneapolis rates. The prices agreed upon by the parties interested is $7,500 for the Bloomington property and $30 per station for approximately seventy stations at Savage. The Tri-State Telephone & Telegraph Company intervened and did not object to the sale, but requested that the commission's order provide that the present connections of the Tri-State toll lines with the Bloomington and Savage exchanges be continued. The Shakopee Company claims that the line of the Tri-State Company connected with the Bloomington and Savage exchanges is not a toll line but a local party line connected with Minneapolis. The Northwestern Company declared that negotiations for the purchase of the property would cease if connection with the Tri-State line was required. The commission made an investigation to determine what kind of circuits of the Tri-State Company were connected at Bloomington and Savage, and found there is but one circuit of the Tri-State Company connected with these exchanges.

The record would indicate that there is not a serious demand for connection between the line of the Tri-State

Company and the exchanges of the Shakopee Company at Bloomington or Savage and that the subscribers served by these exchanges would not be inconvenienced if the connection did not exist. If negotiations cease for the sale of this property, the Northwestern Telephone Company will extend its lines out of Minneapolis into the territory under consideration and there will then be three companies competing for the business. This would bring about a condition under which the people will be put to the serious inconvenience of finding it necessary to subscribe for two or more telephones in order that they might receive adequate telephone service. The Northwestern Company proposes to develop the territory extensively and will furnish to the subscribers service to Minneapolis and to the other patrons in the community much more adequately than is now being done.

It is therefore ordered that the Northwestern Telephone Exchange Company be permitted to purchase from the Shakopee Telephone Company of Shakopee, Minnesota, the local telephone exchanges of the latter company located at Bloomington and Savage, Minnesota.

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Application has been filed by the Knapp Telephone Company, in which it is alleged that the company has in the past been furnishing service to its stockholders at the rate of $5 per year and to non-stockholders for $12 per year, but that at the annual meeting of the stockholders it was voted to buy the telephone instruments now owned by the stockholders and to charge them the same rate for telephone service as is being charged to non-stockholders; that because of the increase in the cost of materials for construction and maintenance, it is necessary to increase the rate for telephone service from $10 to $12 per year.

A hearing in the matter was held at Cokato, Wright county, on March 20.

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The commission has ordered that the Tri-State Telephone and Telegraph Company be required to connect its local exchange at Thief River Falls with the toll lines of the Northwestern Telephone Exchange Company for the furnishing of toll line service to the subscribers and patrons of said companies; that the expense of making such physical connection and the maintenance thereof be apportioned equally between said companies; that the Northwestern Telephone Exchange Company pay to the Tri-State Telephone and Telegraph Company a service charge of five cents for each "in" and "out" message, the said charge to be absorbed from the rate and that an additional charge of ten cents be added to each toll line message moving over the toll lines of the Northwestern Telephone Exchange Company to or from subscribers' stations of the Tri-State Telephone and Telegraph Company at Thief River Falls, said charge to be paid to the Tri-State Telephone and Telegraph Company and not to be absorbed from the rate, this order to become effective thirty days from March 19, 1917.

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Application has been filed by the Watertown Telephone Company for authority to purchase the Delano exchange from the Northwestern Telephone Exchange Company, in which it is alleged that the petitioner owns and operates a telephone exchange in Delano, together with rural and farm lines and toll lines connected therewith; that there is also in operation in Delano a local telephone exchange owned by the Northwestern Telephone Exchange Company; that the consolidation of the exchanges of the petitioner and of the respondent is desirable and that such consolidation would provide better and more extensive service for the patrons of both companies; that such consolidation would affect economies in operation, as well as a saving to the public and the telephone users in Delano, and would improve in every respect local telephone exchange service as well as the toll service.

A hearing in the above matter will be held before the commission at its office in the State Capitol, April 4, at 10 a. m.

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The city of Owatonna, Minn., will not appeal from the order of the State Railroad & Warehouse Commission which has ordered that physical connection be established between the local toll lines of the Tri-State Telephone & Telegraph Company and those of the Northwestern Telephone Exchange Company, according to City Attorney W. F. Sawyer who represented the city at the hearings preliminary to issuance of the order by the commission.

James Adair, member of the City Council, has filed an appeal from the order. Attorney Sawyer says that Alderman Adair is acting in the capacity of an individual citizen and not as a representative of the City Council. "His appeal is taken solely for the purpose of eliminating the differential charge of ten cents a message, which is the main objectionable provision of the order made by the commission," Attorney Sawyer said.

Both telephone companies will take appeals from the order, the commission has announced and thus three appeals will be taken to the Steele County Court.

The commission announced that the appeals would be taken to the District Court at once.

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## New York

Calling the operator a "bum" or intimating that it would give extreme pleasure to see her "bust a leg," is not permitted in good society, according to a decision by the Public Service Commission. Any telephone subscriber who indulges in such practices assumes the risk of having his service discontinued. The same applies to any person who calls up the manager of an exchange and gives it as his private opinion that said manager ought to be out with a pushbroom for the street sweepers.

All three of these things were charged to Morse M. Frankel, secretary and editor of the Mediator Publishing Company, New York. He also "maliciously placed the receiver of the telephone against the transmitter to make a shrieking noise over the line," and was alleged to be "the author of profane and obscene language over the telephone."

As a result of these practices, extending over several years, the company discontinued his service. Mr. Frankel complained to the Public Service Commission. At the hearing the company produced detailed records, giving the dates, hours and minutes on which Mr. Frankel had presented his compliments to the operators and managers of the exchange, sworn to by many witnesses. The commission decided the telephone company had the right to discontinue service not only to Mr. Frankel, but to any other subscriber who knowingly permits him habitually to use the telephone.

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## Nevada

The Nevada commission has ordered that on or before April 1, 1914, Bell Telephone Company of Nevada desist from its present custom of requiring a de-

posit of five dollars or any other sum, from its patrons and customers, upon the installation of a telephone. It is further ordered, that from and after said date, or whenever the custom of demanding an advance deposit shall be discontinued, two months' payment in advance may be demanded by said company as a precedent to the installation of new telephone service for any would-be patron or customer, and that, after the expiration of the two months' period, the respondent company shall be permitted to demand and receive one month's payment in advance, as a condition of the continuance of such service.

The commission makes the following comment:

For the purpose of a clear understanding it may be well to state what has been characterized by the company's representative as the "present plan" with reference to the deposit for installation:

> A five-dollar deposit is required on new contracts for regular exchange service subject to the approval of the application for service by the company, and is returned to the subscriber if the service is not established.
>
> Upon fulfilment of the terms of the contract, the deposit is refunded to the subscriber, with interest, at the rate of six per cent per annum, or is placed to the credit of his account if he so elects.
>
> Upon the nonfulfilment of the terms of the contract, the deposit is forfeited by the subscriber. The deposit is returned, however, to the subscriber, without interest, in the event that a new occupant of the same premises signs a one-year contract, and then tenders a deposit therefor, or at the time we refund the deposit to the original subscriber.
>
> Exception to plan: It has been found advisable to make exception in extraordinary cases where there could be no question as to the subscriber's credit.
>
> Pending the fulfilment of the terms of the contract, the guarantee deposits are carried on the general books as "Acounts Payable." Upon fulfilment of the terms of the contract, the subscriber is at once notified and, at his option, the deposit, plus interest at six per cent per annum, is refunded or applied to the credit of his account. Forfeited deposits are transferred from "Accounts Payable" and taken up as "Exchange Revenue—Subscribers' Stations."

In defense of this plan, requiring a deposit of five dollars, as stated, the following reasons are given, which reasons are discussed in the order of their statement.

First—"The installation of a telephone and furnishing service requires an immediate outlay on the part of the company."

To this reason it may be answered that every act performed by a telephone company, or any other public utility, that is requisite for the rendering of the service, standing by itself, is an item of expense. The aggregate of these items makes up the aggregate expenses of the public utility. We are not able to appreciate the force of the contention that every specific item of such expense should be specially provided for in the conduct of the business of the utility. It seems to us that the charges made for the service should be so adjusted as to afford the company a fair return for the service as a whole. It attempt is made to single out particular items of expense and provide for them specially, no good reason appears why the same should not be done with regard to *all* items of expense, which would lead to a very complex business situation. The installing of telephones is an essential part of the business of a telephone company. Without such installation the service cannot be rendered, therefore sound business policy would seem to require that charges should be applied which would cover the service as a whole, which necessarily includes every specific item of expense.

Second—"Short-term contracts—that is, contracts for periods of less than one year—are unprofitable at regular rates."

This reason is not appealing. It involves in principle the same idea as that contained in the first reason quoted, namely, that every item of service should be profitable in itself. This does not seem to us to be sound. It is almost impossible to imagine any line of business in which every item or branch is profitable in itself, or would be profitable if it stood alone. Take, for illustration, the charges of a transportation company for carrying passengers. Assume that the rate is 4 cents per mile Obviously there is no single mile segment of any railroad in the State of Nevada that would be profitable if operated by itself upon that basis. But the railroad is considered as a whole; its business is treated as an entirety. The long hauls and the short hauls enter into and make up the sum total of its business. If, upon the whole, that business is profitable, the carrier should be satisfied.

And this is the principle that is quite generally acted upon today by commissions and courts. We can see no reason why the business of a telephone company should not be treated as an entirety. Some patrons have their telephones installed and keep them in place for many years. Others retain them but a short period of time. But if, upon the whole, the business is fairly remunerative, the telephone company has no just cause for complaint. If the respondent company had no business except the patronage of those who retain their telephones for one year or less, it is safe to say that it would not continue in business very long.

The third reason is "That the disconnection of a telephone is an additional expense to that of the original installation."

This involves the same idea as that set forth in the first two reasons quoted. It goes without saying that the disconnection of a telephone, considered as a separate and distinct act, involves some expenses—much or little, according to circumstances—but, as before stated, it enters into and forms a part of the general expense account and should only be considered in its connection with the business as a whole.

The fourth reason given is "Many telephone users discontinue service for various causes before the expiration of the contract, and, frequently, their accounts become uncollectible. As the cost of installation, operation, and disconnection, to which uncollectible moneys must be added, often exceeds the annual rental rate, the company suffers definite loss, which, naturally, has to be borne by its patrons."

We do not see how the foregoing adds much, if anything, to the force of the reasons previously quoted. It simply goes to show that in the transaction of its business the company takes some chances of loss through its short-time customers. But the principle involved in nowise differs from that of the case of a carrier whose short-trip passengers would not, as a separate item of business, be profitable. Everything that is said in the reason last quoted might be true, and at the same time it not follow that the deposit theory would be sound or equitable. The avowed reason for exacting the deposit is to save the company from loss, and it is declared by the company itself that the deposit is not fully effective for that purpose. The deposit charge is clearly an injustice to the honest patron who retains his telephone for more than a year. Even though it be returned to him at the end of that time with 6 per cent interest, he has actually been obliged to make what is, in effect, a forced loan to the company—this in pursuance of a custom which has been inaugurated by the company to protect itself against those who are the least honest and least permanent in their patronage.

The fifth reason given for requiring the deposit is that "Monthly rental in advance is not sufficient protection."

This may or may not be true, if we consider separately each account which it is desired to safeguard. But it brings us right back to the proposition heretofore made that the business should be considered as a whole, and not be conducted with reference to the consequences which may follow from particular transactions. It may be said with equal force that advance payment by a passenger upon the railroad, who rides only one or two miles, would not make the carrying of that passenger, alone, a profitable transaction. But the facts are that the trains are being run regularly, passengers get on and off at almost every station, some travel longer distances than others, and altogether they make up the sum total of the railroad company's passenger traffic.

So with the telephone business, some continue their patronage for a long number of years, paying regularly and promptly, all the time, while others continue their patronage for only brief periods. As long, though as the charges are made in advance, and the company is active in the collection of such charges, we are not able to see why there should be any considerable loss through short-time patrons.

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## Ohio

Much agitation has been started since the Public Utilities Commission increased the rates from $4 to $11 a year under the new schedule filed with the state by the Ohio State Telephone Company.

No changes are made in the charge for residence service.

The charge for individual business lines is boosted from $40 to $51 a year, and that for two-party business lines from $36 to $40.

"Increased prices due to the war," is the company's explanation regardless of the fact that they are making no new extension or repairs and most of the material on hand was purchased at the old price.

Petitions will be filed at Delphos, Dayton, Canton and other points. It has been pointed out that the service in the latter place is particularly poor and the city council is after their scalp.

The Central Union and Ohio State Telephone companies will have to carry out promises of better service within 90 days or council will appeal to the state public utilities commission.

This was the substance of the report of the special committee named to probe the telephone service, as presented to the Canton council and adopted.

The failure of the franchises of the companies to give the city any redress in the event of poor service leaves an appeal to the state commission the only means of enforcing requests, the report states. In view of the poor service being received the committee is absolutely opposed to any increase in telephone rates in Canton, the report asserts further.

It is stated that the increase has nothing to do with the exchange of five per cent bonds of the companies which consolidated into the Ohio State Telephone Company was authorized by directors of the company at a meeting in Columbus, dispatches state. The bonds will be exchanged for $5,032,000 maturing bonds of the three subsidiary companies as authorized by the consolidation approved by the state utilities commission in 1914.

The new issue of $5,000,000 will pay four per cent until July 1, and thereafter will pay five per cent, it is stated. It is stated the basis of exchange is to be at the rate of 90 for the new Ohio State bonds and 100 for the old bonds of the subsidiary companies.

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In disposing of the case of the city of Lima vs. the Lima Telephone and Telegraph Company, the Public Utilities Commission states that duplicate property of merged telephone companies shall not be entitled to earnings. The commission reopened its valuation made last July as of January 1, 1915, when it found reproductive value of $845,404.86; depreciation, $144,686.56, and present value, $700,718.30, and deducted duplicate property found not to be used and useful for the service of the public. This property had a reproductive value of $109,528.66 and had depreciated to its present value of $56,621.75.

The commission made allowance for additions and betterments made to the plant between January 1, 1915, and August 31, 1916, and found the values of the property actually used for the service of the public: Reproductive, $768,655, and present, $677,222.95.

The duplicate property in this case arises from the fact that some years ago the commission authorized the Lima Telephone and Telegraph Company to purchase the Lima plant of the Central Union Telephone Company. Following this unification of the properties the company filed a new schedule of rates to become effective March 1, 1915, which were immediately challenged by the municipal authorities. The interim has been used by the commission to appraise the property, its findings being closely questioned by the Lima company at every point.

The company has steadfastly insisted upon a valuation of $900,000, necessary to establish a proper relation of its outside securities.

While attacking primarily the new rates, which were constructed in view of the elimination of competition, the complainants included allegations of insufficient service. The commission in disposing of the complaint dismissed all challenges of residence rates and the company's service. It did, however, reduce the business rates $6 a year.

The Independent company, under the competitive conditions, charged $36 for single-line business phones and $30 for two-party service. The Bell rates for these two classes of service were $42 and $27 a year. After purchasing its competitor, the Lima company proposed to charge $54 and $42 respectively. The Utilities Commission finds that the reasonable rates are $48 and $36, and that all collections in excess of its rates from March 1, 1915, the date the company established them, are unlawful. The commission thus provides for the recovery of excess collections from the company.

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The Ohio Public Utilities Commission made its decision in the case brought against it by Guy Findley as a taxpayer, in which he endeavored to have the telephone company ordered to reduce rates and also to give the city better service.

The commission decided that the rates were all right and refused to order a reduction except in the charge of 25 cent desk telephones in homes, which charge was ordered discontinued. The commission also decided that the telephone company must give better service in the city.

The telephone officials state that they would have given better service long ago, if the suit had not been started. They had made all arrangements for a new telephone switchboard and even may put up a new up-to-date building, with strictly modern equipment. Not knowing what the commission would do in the case, they allowed things to go on as they are until they knew what would be required of them.

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## Oregon

The Tillamook County Mutual Telephone Company has brought complaint alleging the service of the Pacific Telephone & Telegraph Company is insufficient and inadequate, and its practices unreasonable and unjustly discriminatory in that it fails and refuses to permit the installation of a physical connection between its telephone system and that of the Mutual Company and to allow the interchange of traffic thereover.

The Tillamook County Mutual Telephone Company owns and operates a telephone system in Tillamook county consisting of a number of rural lines which are connected to and operated as a part of an exchange plant, also owned by it, which serves the city of Tillamook, Oregon.

Although the complaint covered the question of interchange of both local and long distance business, the plaintiff announced at the hearing that a connection for the interchange of long distance service only was sought, and the testimony introduced was confined to this feature.

The record shows there are numerous patrons of the Mutual Company in the rural district surrounding Tillamook who are not located contiguous to the lines of the Pacific Company and are not subscribers to its service, and that they have urgent need for long distance service. These people are located at distances varying from a few hundred feet up to several miles, from the nearest Pacific Company line. Under the present conditions, if they desire long distance service it is necessary for them to travel these varying dis-

tances to avail themselves thereof, or, as suggested by the Pacific Company, to install the service of that company. The general practice has been to travel the distance rather than to install the service. Nor is this travel limited to the distance to the nearest Pacific Company subscriber telephone, but, on the contrary, they travel, in most instances, to the nearest public pay station maintained by that company. Although a neighbor may be a subscriber to the Pacific Company's service, in a large number of cases the party desiring the long distance service will go to a public pay station to avail himself thereof. This is due to a large extent to the natural hesitancy in invading the privacy of another's home to transact business in which the owner of the home has no interest, and is a condition fostered by the Pacific Company by its strong discouragement of the use of private residence and business telephones by outside parties.

A study of the record regarding the suggestion that the party wishing long distance service should subscribe to the Pacific Company's system, develops the following facts:

The Pacific Company has inaugurated a general rule relating to the building of extensions which, briefly stated, is as follows: The company will extend a line, without expense to the subscriber, to any point, the construction of the line to which will not entail an expenditure in excess of two years' receipts from the service furnished by that line. Beyond such point the subscriber must participate in the cost of construction. This rule is varied in individual instances by the particular conditions regarding prospective development of additional business, etc., found to exist. The average cost of ordinary, farmer-line construction by the Pacific Company in Tillamook county, is in the neighborhood of $140.00 a mile. The regular published tariff rate of the Pacific Company for farmer line, party service, in this territory is $1.50 per month.

These facts, taken in connection with others disclosed by the record as to the ability of the subscriber to pay and the amount of use he has for the Pacific Company's service, lead the Commission to the conclusion that the cost to many of the citizens of Tillamook county, now served by the Mutual Company, of obtaining the service of the Pacific Company in their homes is more than the value of such service to them.

We do not believe the contention made by the Pacific Company that they are in a position to furnish their service to all who may require it in this territory at a reasonable cost to the patron has been sustained.

In the light of the entire record, the commission finds that just and reasonable terms and conditions for the installation and use of the physical connection between these utilities are as follows:

(1) The Mutual Company shall, at its own expense, install and maintain the necessary plant and equipment to connect up its system with that of the Pacific Company at the latter company's exchange terminal, so as to make possible the interchange of long distance traffic between the two companies.

(2) On all calls interchanged under this order between the Mutual Company and the Pacific Company there shall be charged, in addition to the regular, published tariff rate, the sum of 10 cents, which 10 cents shall not be absorbed by either company but shall be collected from the subscriber or patron availing himself of the service afforded by the physical connection between these utilities.

(3) Each company shall be responsible for all tolls charged against its own subscribers or patrons, including the 10 cent differential herein provided, and shall, on or before the 10th of the month following that in which the service was rendered remit to the other the sum of 5 cents for each interchanged call for which its subscribers or patrons shall be liable.

It was therefore ordered that on or before March 15, 1917, the parties to this proceeding provide the necessary plant and equipment and do all matters and things reasonably necessary to provide for the interchange between them of all long distance traffic originating at or destined to stations upon the lines of the Mutual Company without the corporate limits of the city of Tillamook, and thereafter interchange such traffic without discrimination and without restraint. Such facilities shall be provided and such long distance traffic interchanged thereover under the terms and conditions set forth as just and reasonable.

The application of this order is confined solely to the intrastate transmission of messages between points wholly within the state of Oregon, and shall not be construed as in any wise affecting interstate commerce.

## Pennsylvania

At a short session of the public service commission in Pittsburgh, March 15, a reduction of $314,000 a year in the cost of telephone service to subscribers in the Pittsburgh district was agreed to by counsel for the Central District Telephone Company and the Pittsburgh Chamber of Commerce.

W. D. B. Ainey, chairman of the commission, hearing the complaint of the Chamber of Commerce against the telephone company, intimated that the compromise would be acceptable to the public service commission. It does not affect the flat rate charges, it was announced.

According to Assistant City Solicitor C. K. Robinson, the proposed reduction will mean an average saving of about nine per cent to the individual subscriber. This will apply to all users of telephone service on a measured basis, which includes residences on two or four party line and business houses which pay according to the number of calls used.

This action marks the most important step in a prolonged fight instituted against the telephone company by the Chamber of Commerce in behalf of the local subscribers nearly four years ago. W. L. Rodgers, chairman of the special committee on the telephone rate complaint, said it means a decisive victory for patrons of telephones not only in Pittsburgh but throughout the state, and will affect the situation nationally.

Attorney H. H. Findlay French, representing the Chamber of Commerce, said the chamber would be willing to mark its complaint "Settled and satisfied," provided a total reduction be made of $314,000 in the cost to subscribers, $297,000 being a reduction in the cost of local service and $35,000 a reduction in the cost of toll calls originating in the Pittsburgh district, based on the company's revenues as of January 1, 1917.

Attorney Robert V. Marve of New York, general counsel for the telephone company, said if the suggestions of the Chamber of Commerce and the city of Pittsburgh receive the approval of the commission, the telephone company will file with the commission a schedule of rates which it has submitted to the chamber and the city and which it is believed will bring about the results stated by counsel for the chamber.

## Telephones on War Basis

The entire system of the American Telephone and Telegraph Company, extending from coast to coast, has literally been placed on a war basis as the situation with Germany becomes more acute.

The War Department at Washington can get into direct and almost instant communication with every fort, large city and vital military point throughout the country should war be called. The placing of the system on a war basis has been carried out by numerous experts.

If war is called, men of the company will at once be appointed majors in the Signal Officers' Reserve Corps, U. S. A. This will be in line with the appointment recently of Chief Engineer J. J. Carty of the American Telephone and Telegraph Company as Major in the Signal Corps.

"The abnormal commercial business," said one of the officials, "has caused a wonderful development of the system. This has raised it to the highest point of efficiency. The result of this development would, of course, make it more easy to handle business for the Government in the event of war.

"Should war come the entire system would be devoted to the handling of messages for the government, which will have precedence over all others."

The present development in the situation recalls the test which was made last summer with the service of the American Telephone and Telegraph Company under hypothetical war conditions.

At that time Secretary of the Navy Daniels was in communication with the Pensacola, Fla., Navy Yard in 45 seconds.

It required only 28 seconds to get into touch with the navy yards at San Diego, Cal.

The present plan of bringing up the system to a war basis has included the installation of "repeating systems."

Should a crisis come, it was pointed out, the first step of that telephone system would be to flash messages for the government to forts and military points throughout the country.

Next would be the communicating with camps and the transferring of orders for the mobilization of soldiers.

The system would then play an important part in the establishment of signal service between the various lines of defense.

## Medal for A. G. Bell

Alexander Graham Bell has been awarded the Civic Forum Medal of Honor for distinguished public service at a meeting of the forum held in Carnegie Hall, New York.

President John H. Finley of the University of the State of New York presided. Edwin Markham read a commemorative poem, and brief addresses were delivered by Thomas A. Watson, maker of the first telephone instrument and receiver of the first telephone message; Dr. Henry S. Pritchett, president of the Carnegie Foundation; John J. Carty, chief engineer of the American Telephone and Telegraph Company; Rear Admiral Robert E. Peary, and Union N. Bethell, president of the New York Telephone Company.

This medal has been conferred twice thus far, three years ago upon General George W. Goethals and two years ago upon Thomas A. Edison. The medal is awarded not oftener than once a year by a national council of about seventy members representing the whole country geographically and as far as possible in every other respect. The medal is intended to express the sentiments of the rank and file of the American people as distinct from an honor conferred by a university or learned society.

The medal itself is of gold and is the largest and intrinsically the most valuable in this country. The design, which is by the sculptor Paul Manship, was selected by the late John W. Alexander, Daniel C. French, and Robert Underwood Johnson.

## Physical Connection Bill in Tennessee

Senate bill 272 in Tennessee provides for the interchange of physical connections by telephone companies.

At the request of Dr. Caudle of Columbia and others an amendment was agreed to to exclude from the provisions of the bill all home and mutual companies.

Arguments were presented for the passage of the bill as amended by Terry W. Allen of Jackson, representing the Sun Telephone and Telegraph Company, and other Independent telephone companies in the state. He explained that similar laws have been passed in other states, and have been upheld as constitutional. He said that it provides for the interchange of service for which due compensation is to be made. The bill provides, too, that the telephone companies shall be under the direction of the railroad commission.

## Indiana Bill Decreases Stock Liability

The Senator Metzger stock bill has been sent to Governor Goodrich. The bill repeals the provision in the present law making stockholders in Indiana telephone companies liable for twice the face value of their stock.

Its passage was urged on the ground that this double liability, not required in any other kind of corporation except banks, was a discrimination and a handicap on the organization of Independent telephone companies in Indiana. Bell interests, not incorporated in Indiana, fought the passage of the bill. The governor accepted the bill for action, though it was among the bills whose acceptance by him was optional.

"I have not studied the bill yet," the governor said, "but I hardly would receive it if I did not intend to sign it."

The Chicago Telephone Company has filed a petition with the Illinois public utilities commission asking for an order by the commission authorizing it to issue capital stock to the amount of $6,000,000. The stock will be offered to stockholders at par as soon as sanction is given by the commission.

An eight-page booklet on the Harpoon Guy Anchor by the Crouse-Hinds Company of Syracuse, N. Y., gives all the information necessary about that useful device, and interestingly illustrates its use. The price list is on the back page.

"Ask Her," is the title of an attractive envelope stuffer in three folds, prepared by the Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., for distribution by its customers to their "prospects," for intercommunicating service.

# Telephone Companies and the Local Press

*Hints for Those Who Seek to Gain Publicity Through Editorial Courtesies—From the "Automatic Telephone"*

BY WALLACE MEYER

DON'T expect your local newspaper to give you any free advertising whatever—you have no right to ask for it—and then if you do get it your satisfaction will be all the greater.

Your local newspaper pays you your regular rates for the telephone service you sell to it. The publisher with justice expects you to pay him for space used when you advertise in his paper. Yet whenever there is news concerning or involving the telephone company or any of its officers or the operating staff, the newspaper is glad to print it, for the telephone is as much a part of your community life as are the street railway, light, water, heat, and power utilities. In view of this fact, it is to your advantage if you know how to distinguish "news"—and, appreciating the value of news to the newspaper man—if you can and will help him to get live "stories," about or touching on your telephone company and its activities.

What is news? Although there is no need here to go into a study of journalism, it will be well to borrow from the stock definitions of news which editors have compiled for the instruction of their "cub" reporters from time to time. To summarize, anything that is unexpected, unusual, strange, significant, mysterious, exciting, historic—anything that is of general interest to the largest number of readers—is news.

An unheralded visit to your exchange by a party of distinguished foreign engineers—an event both unexpected and unusual to the public—would be good news for your local paper. These prominent visitors would be interviewed, they would say nice things about your city, about your automatic exchange, and, if your paper is large enough the editor would have pictures taken of the party, together with the local manager and perhaps the mayor. That, at least, is a rough sketch of what such an event would amount to from the news standpoint of the paper, and the publicity standpoint of your company. So much will suggest what is meant by the unexpected and unusual.

"Aurora Borealis Puts Telephone Lines Out of Commission." Here is the headline for a good "strange" story, and yet a reasonable and not uncommon one, for many cases are on record where electrical disturbances of a spectacular nature have disarranged and disturbed telephone and telegraph lines. The newspapers do not mention each display of the aurora borealis, but the more prolonged and distinct exhibitions of the "northern lights" are usually noted in the press next day. No editor would turn down an authentic story of how many telephones were found out of order the "morning after."

Then the fact that the automatic company is increasing its switchboard capacity by 500 or 1,000 or 10,000 lines, makes news, news of a significant character. Like increased post-office receipts, U. S. census or city directory figures—or the promise of a new big industry—any increase to the telephone facilities of a city gives the papers a perfect right to publish that they have new proof of the city's progress. Not alone is increased capacity significant, for the replacing of overhead wires by cables or of cables by underground conduits amounts to almost equally good news.

Anything mysterious which may develop over or concerning the telephone, makes copy for the fluent reporter. So does any exciting incident, as when the automatic is used to check the advance of a catastrophe by flood, or fire, or hostile forces. It is just as much good news—though of a different stamp—when your company celebrates its first or any other anniversary. In this connection the public appreciation of the superior automatic service will be mentioned if it is brought to the editor's notice.

And when the mannually operated rival finally gives up the ghost and you cheerfully take up the duty of extending the automatic telephone to every house and office in the community—that makes historic local news of the first caliber. It deserves and it gets, in newspaper parlance, a "big head."

The same story does not possess the same news value in a large city that it does in a smaller one. For example, it would have to be a foreign commission of considerable note whose visit to a 500,000 inhabitant place would attract first-page notice in the newspapers, but a visit by less famous engineers would make a big story in a town of 100,000.

Again in the matter of unusualness, such as the influence of a spectacular electrical display on the wire systems, a disturbance which the small city editors might consider worth a first-page story would probably be pushed "inside" by the big city editors. Other considerations which may affect the relative news values of similar events and incidents in different cities, are the number of local telephone companies in the field, and the degree of friendliness or hostility maintained among the competitors. Where the automatic has the field to itself, the editor may be expected to give more generous treatment to news which comes from your office.

Paid advertising also affects, indirectly and quite unconsciously, the news value of the telephone items which you may pass on to the newspaper. For instance, if the advertising solicitor of a newspaper is repeatedly sent away from your office without a contract or without the copy he would like to secure from you for his columns, then you must not feel aggrieved if the newspaper editor finds it difficult to see anything of interest in the "stories" you want him to publish. For a paper cannot pay its reporters and operators and pressmen and bookkeepers and its news service and its print paper bills through any increased circulation revenue which well-written telephone stories may bring to the office. Indeed, the average American newspaper receives two-thirds of its revenue from the sale of advertising space and only one-third from sales and subscriptions.

On the other hand it is well to remember that paid advertising must not be used as a lever to force the newspaper to distort or strangle news, that is, really live news, which affects the telephone company. Any private or quasi-public business which attempts to influence the freedom of the press hurts itself. Every city whose press is free to tell the truth is better off, and so are the business institutions within the city. Take an extreme case. Imagine, if you can, that your exchange should fall down in an emergency, that it is put out of business by an accident or a catastrophe or through the mistake of an officer or an employe. You may be a heavy advertiser and as such you may go to the editor and demand that he conceal the true conditions affecting your company. If he yields and does so the public will soon lose faith in his honesty—because, in spite of your efforts to befog the true situation, the public will eventually learn the truth—and it will also lose faith in you.

But suppose you help the editor to give the whole story, to get all of the news connected with the affair, even though it may be unpleasant and distasteful to you. Immediately the public will feel that here is a free and fair newspaper. Its news columns are not controlled by its counting room. The next time your advertisement appears it will enjoy the added prestige which comes from association with such an institution, a newspaper respected for its honesty. And your advertisement will be the more carefully read because of your frankness in telling the reporters what it was that happened to your lines.

As a newspaper reporter I used to get stories frequently from the manager of the telephone company in the city where I lived. This manager had a son who worked on the paper, but even before the son's connection with the news staff, the manager showed a decent appreciation of what was news and what was not news.

He had, however, one fault of which I helped break him. It was an inclination to report—after each bad storm, when lines were broken down north, and south, and west, (there was a large lake to the east of our city) that his local and long distance lines were practically uninjured. Now that statement was often untrue. And people began to suspect that it was untrue because they could see no reason why the telephone lines should stay up and give uninterrupted service when nearly all of the telegraph lines were, for the time being, hors de combat. After several straight talks with my friend, the manager, he began to see the matter in a different light, and even to this day, whenever there is a serious disturbance of any sort in his territory, he instructs the wire chiefs to give accurate figures on lines out of order to the newspaper reporters. He has adopted a policy of telling the whole truth.

If you were to take charge of the automatic exchange in a town to which you were new, I should make this sugges-

tion: Get acquainted with the publishers, editors, and reporters of your local newspapers without delay. Tell them who you are and let them know that you are willing to cooperate with them in every way, in the gathering of local and out-of-town news, and in giving them whatever news develops in your zone of activity. Then without ostentatious display to the editor, give the business manager an order for advertising to be run in his paper. The editor will think more of you as a man if he sees your advertisements in the advertising columns before he knows that you have purchased space. In small towns the editor and business manager are very often one and the same man. On larger papers the city editor and managing editor are usually both influential men. But no two papers are exactly alike in personnel, and the only safe rule to urge is for you to get acquainted with all the editors and reporters. But not all at once. Don't rush the process. If you do they'll become suspicious of you.

Never by word or deed, give a reporter reason to think that you aren't "on the square." There may be occasions and there may be reason for giving a "scoop" to one reporter or editor in preference to the men of another paper. But the safe thing to do is to follow the example of Maclay Hoyne, the distinguished and progressive public prosecutor of Cook County, Illinois, who for a period of several months has been making news of first-page value almost every day. All the papers, regardless of politics, treat Mr. Hoyne with the utmost liberality, and not the least reason for this support is the fact that the prosecutor will not give out a story until the reporters from all the afternoon or morning papers are on hand.

No man on earth remembers a broken promise longer or more carefully than a reporter. And I do not believe that there is any group of men to whom it is safer to confide than to reporters. A secret, or a story for future publication is as safe with a reporter as if it were locked in the federal treasury vaults.

The editor of an afternoon paper may not be able to send a reporter if you telephone him at 2 o'clock that you have a story, for the hour from 2 to 3 on, is about as crowded as a manual switchboard on election night. He will be glad to send a reporter over after "30" to get your story for the next day. And in the matter of space, please do not try to designate to the reporter or editor how long your "story" should be, or where it should be placed. In the long run you will gain the editorial respect and courtesy by leaving such matters to the editorial discretion, for the editors, and not you, are paid to make up the paper. When your news is really worth a big story, well "played up," you will see it so treated.

There are other considerations such as the timeliness of the story, the tone, whether optimistic and broad and constructive, the day of the week, and the public attitude toward your company, all of which enter into the matter of securing publicity for your telephone company.

## Supplies Doubled, Rates Stationary

At a meeting of the managers of fifteen telephone exchanges of Western Illinois at Monmouth the men declare that the cost of materials for the equipment of exchanges has almost doubled over the price of two years ago, and some of them are finding it difficult to make ends meet. A few declared that they were breaking even, and that is about all. Under these conditions, it is not considered advisable to make improvements to exchanges, but regardless of this several of the companies have made repairs to improve their service.

One of the important matters brought up and discussed had to do with fights that towns are having where two exchanges are located. The meeting declared such a condition to be deplorable, as it is injurious to the best interests of the company and to the service. They recommended that the exchanges combine. This, they believe, would effect a saving for the companies and for the subscribers.

The following towns were represented at the meeting: Monmouth, Keithsburg, La Harpe, Macomb, Stronghurst, Media, Kirkwood, Biggsville, Seaon, Little York, Aledo, New Boston and Sherrard.

## Decorators Attack the Telephone

That instrument of modern advancement in civilization, the telephone, without which no dwelling is complete, is oftentimes an unsightly article which it would be better to hide. In the boudoir it is pushed between calls into an enameled cabinet and sometimes the same treatment is accorded it in the living-room, where a painted wall closet offers concealment.

But here is a description of a telephone corner which, in spite of the presence of the instrument in question, was particularly attractive. First of all, there was a Chinese lacquered telephone table of black and yellow, with dull Chinese landscape and figures painted on its surface. A low chair was made to fit under the table exactly. A shelf under the table top left just enough room for the insertion of a telephone book of generous size. This book, by the way, was covered with a black and yellow and peacock blue printed linen in Chinese figures. A tab on the edge of the cover projected from the shelf, so that it could be pulled out with ease.

A screen of the printed linen was high enough to hide the unsightly phone. Beside the screen reposed a small elbow cushion, also covered with the linen. This is acknowledged by all who use it as a great comfort for the lengthy phone talk. A phone list for a few often used numbers was slipped into a hanging panel of the linen tacked just above the table. Thus, instead of bewailing the presence of the phone in an otherwise lovely room, the decorator made of it an excuse for the introduction of several unusual novelties.

## Central Union Buys Competition

A petition by receivers of the Central Union Telephone Company for permission to buy 1,498½ shares of stock in the Citizens Telephone Company of Kokomo was approved by Judge Thornton, of the Marion superior court, where the Indiana receivers for the Central Union were appointed several years ago.

The stock of the Citizens company, it is understood, can be bought by the receivers for approximately $100,000, and would give the Central Union control of the company, as it now owns 1,501½ shares.

A similar petition was approved recently by the superior court of Cook county, at Chicago, where the principal receivership proceedings are pending. The action of the court here will enable the receivers to go before the public service commission and get the approval of that body on the proposed transaction, which the receivers say will improve and extend Kokomo telephone service.

## Municipal Purchase Without Bonds

A bill has been introduced in the house of the Indiana Assembly authorizing cities and towns to buy any public utility without using municipal bonds therefor and permitting any bonds issued in payment for the property to be secured by mortgage on the utility purchased.

Under this bill any obligation that is incurred by a city or two will not be considered a debt within the meaning of the constitution. While the measure is intended to meet a local situation, it is broad enough to cover every city and town in the state which may desire to buy and operate public utilities.

# Of Interest to the Trade

*What the Telephone and Accessory Manufacturers Are Doing to Advance the Art*

## A well Designed Test Set

If there is anything a lineman dislikes it is to go around loaded down by a heavy test set, and you can't blame him either because he has enough tools of other kinds to "tote." On the other hand he wants an efficient equipment—one that will do its work and do it well.

The Stromberg-Carlson equipment engineers worked from the lineman's point of view as well as their own when drawing up the details of the No. 844 Test Set, which is illustrated. This equipment includes all of the apparatus found in a local battery telephone and its talking and ringing qualities are equal to a full size instrument. The apparatus is assembled within a strong oak cabinet which measures 8½x7x5¼ inches and weighs only 12 pounds 8 ounces.

The talking equipment includes a transmitter of standard size and type, a watch-case type bi-polar re-

*Stromberg-Carlson No. 844 Test Set.*

ceiver and induction coil. The transmitter is contained within a moisture-proof case which is mounted in the door flush with the woodwork—out of harm's way. The receiver is held in its place on the top of the cabinet by a combination retaining spring and hookswitch. When the receiver is removed the hookswitch closes the battery circuit through the transmitter and induction coil and the set is ready for use. Current for talking purposes is supplied by a cylindrical two cell flash-light battery.

The powerful hand generator has a large output sufficient to ring heavily loaded lines and for making all ringing tests. A sensitive alternating current buzzer gives a clear loud signal when testing or when receiving calls from central or stations on the line. No. 844 Test Sets are furnished with equipments for series or bridging line service.

Further information regarding this instrument can be obtained from any office of the Stromberg-Carlson Company or from its traveling salesmen.

## Carbosota a Pole Preservative

In general the preservative treatment of poles is an economy that is inseparable from modern efficiency in pole line construction. Preservative treatment, which is to be employed by the average telephone company or the small electric light and power company, must be such as to conform to their conditions in that it must be practical and economical.

The preservatives which have been used and which have been thoroughly tested for the preservative treatment of poles are the anthracene oils (known under the trade name of Carbolineum), creosote oil, zinc chloride, sulphate of copper, and other mineral salts. The anthracene oils are expensive and have not proven better than creosote oil. The mineral salts have all been discarded as they are soluble in water and, therefore, leach readily from the wood. Tar has proven a detrimental influence; so, also, has concrete, unless the poles were creosoted previously to being set therein.

In the proceedings of the National Electric Light Association for 1911 appears a table giving the results of a 50-year test made by the German government on treated and untreated poles with various preservatives. Coal tar creosote oil proved the most successful and economical.

When considering the proper creosote oil that shall be employed for the treatment of poles by the brush and open tank method, it must be remembered that it is not only the technical character of the oil which demands attention, but of equal importance are its physical characteristics and its adaptability under the conditions of its applications. In other words, in addition to being effective as a preservative it must be convenient to handle and apply. It must also be available in convenient sized packages, and must be ready for use under all climatic conditions. These requirements led to the development of "Carbosota," which can be purchased from the Kellogg Switchboard and Supply Company. Since the introduction of this product, which was the first material that was suitable for use at a reasonable cost, there has been considerable headway made in the preservation of poles. Therefore, the importance of this point is self-evident.

Brush treatment is effective and in the words of the government (reports by the Forest Service) "gives an increased life to poles sufficient to pay well for the cost of treatment."

Prompt shipments of Carbosota are assured by the Kellogg Company.

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## Extension Service

The Stromberg-Carlson Telephone Manufacturing Company of Rochester, New York, has prepared a neat little folder on Extension Service for Telephone Companies, to use as an enclosure to be sent out with their monthly statements, etc., to their subscribers. The combination telephone is featured and the many reasons for the installation of an extension telephone are clearly set forth. The appeal is directed to the woman of the house and the company's name does not appear anywhere in the copy.

The folder is printed upon a dull coated sepia paper and is printed in brown duotone ink. The Stromberg-Carlson Company states it will furnish telephone companies these folders in any desired quantities free, with the name of the company imprinted thereon.

## Standardization of Key Shelves

An excellent example of advantageous standardization is found in the key shelves of the Kellogg one-position low type magneto switchboards.

This key shelf consists of two parallel wooden strips help apart the length of a standard key escutcheon, by means of heavy angle iron braces, which prevent splitting or warping. Along the inner edges are mounted grooved metal strips forming the key frame.

This construction does away with the old centered holes for mounting the keys, and allows the use of escutcheon plates which fit flush with the key-shelf surface. The escutcheons, whether carrying keys or blank, are held in place by a clevis which is drawn up into the grooved key frame by means of screws through the escutcheon plate.

This method of building a key-shelf enables the same shelf to be used in equipping two different boards of ealh of the one-position sizes. It permits the equipment of any amount of the circuits available up to the capacity of the board.

The accompanying diagram illustrates the layout of this one-position shelf. At the left are located the reversing key and four-party master key. These keys are under the control of the operator's left hand, so that after learning the called-for party, she can set the proper party line combination while reaching up to insert the plug in the jack and be ready to use the ringing key by the time the connection is established.

At the right end of the shelf are the generator switching key, battery key and night alarm key. These keys are seldom touched, and do not interfere with the operator handling her cords, etc., with the right hand.

The present tendency is to dispense with the battery switching key, and use battery contact springs on the listening keys. With the present high cost of dry cells, this practice is generally recommended.

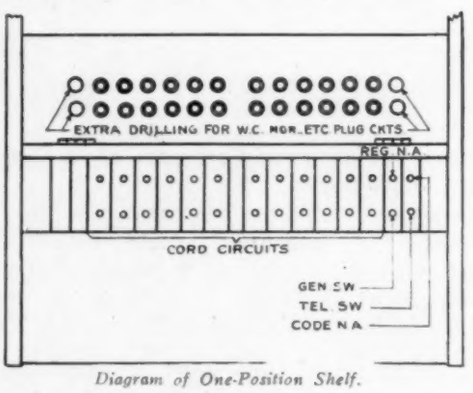
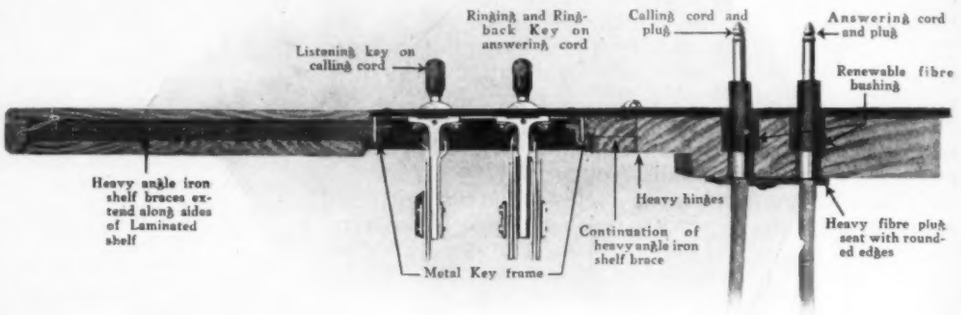



*Diagram of One-Position Shelf.*

In using this key shelf layout, standardization does not mean that the entire shelf must be equipped to full capacity on all occasions, but it means that a standard board will have the keys used located at the points indicated. By establishing a location for the apparatus the entire layout of a switchboard can be improved and simplified, because each piece of apparatus can be placed to the best advantage with reference to accessibility in assembling and future inspection.

The prices of Kellogg switchboards are based on the standard layout and any deviation jars the machinery of production, slowing up delivery and frequently raising the price of the board. Market conditions considered, the shipping record of Kellogg boards


Ringing and Ringback Key on answering cord
Calling cord and plug
Answering cord and plug
Listening key on calling cord
Renewable fibre bushing
Heavy angle iron shelf braces extend along sides of Laminated shelf
Heavy hinges
Continuation of heavy angle iron shelf brace
Heavy fibre plug sent with rounded edges
Metal Key frame

*Longitudinal Section of the Standardized Key Shelf.*

the past three months is remarkable. If a new board is contemplated this spring, the Kellogg company states it can make very prompt deliveries.

## Rochester's New Equipment

The flourishing condition of the Independent telephone industry in Rochester, N. Y., is indicated by a report received from the Stromberg-Carlson Telephone Manufacturing Company, in which the company states that it has received an order from the Rochester Telephone Company for a complete central energy branch office equipment for the "Park" exchange. The "Park" exchange serves the major portion of the east side residential section of the city which is rapidly becoming more populous.

The principal item in this large contract is a central energy lamp line multiple switchboard (40 volt system) which will include every modern service-improving feature of practical commercial value. It will consist of six three-position steel frame switchboard sections making a total of eighteen positions. Multiple jack space is to be provided for an ultimate capacity of 6,000 local subscribers' lines and major relay cut-off answering equipments for 1,500 lines will be installed to take care of present requirements. The answering jacks and lamps will be distributed in four sections before eleven "A" operators' positions using the eight-panel plan of mounting. Four of the positions will serve as "B" or incoming trunk operators' positions in which will terminate 120 incoming trunks from the telephone company's "Stone" and "Glenwood" exchanges. There will also be a hospital position for "plugging-up" lines that are in trouble and a multiple annexed position situated at the growing end of the switchboard.

All "A" operators' positions will be equipped complete with 15 pairs of connecting cords of the three-conductor type with double lamp supervisory signals, flash-

ing recall on the answering cord, automatic machine ringing for both straight and harmonic party lines, and also automatic operator's cut-in and cut-off system. The automatic operator's cut-in and cut-off are to be controlled by a key so that the operator may release her circuit from a cord pair or cut-in on a completed connection in emergencies. Another commendable feature is the arrangement of the automatic machine ringing which instantly disconnects the ringing current at any part of the ringing cycle as soon as the called subscriber removes his receiver from the hook, thus avoiding any possibility of ringing in the subscriber's ear.

The cord equipment in each of the "B" operators' positions will consist of 30 single cords with incoming signal and double lamp supervisory signals, and arranged for automatic four-party harmonic ringing. The incoming trunks from the "Stone" and "Glenwood" exchanges are to be of the call order type. The outgoing trunks to these exchanges will be multiplied throughout the trunk multiple space in all sections. The trunk multiple space provides for an ultimate capacity of 320 trunks of which 120 will be equipped to handle the present traffic.

Operators' breast plate type telephone sets and all associated apparatus are to be furnished for the equipped positions, also auxiliary apparatus, such as pilot lamps, monitors, call key, order wire keys, service meter keys, etc. The line pilot lamps will consist of 15 watt 40 volt green glass Mazda lamps mounted in a special fixture in the top rail of the switchboard. The disconnected pilot will be of the usual type mounted in the plug shelf rail behind red jeweled lamp caps. A monitor's call lamp will be installed in a prominent place in the top of the switchboard above each position. This equipment is to be wired in connection with a single stroke bell so that a combination audible and visible signal will be given when the monitor's call key in any position is depressed. Each "B" position will contain one service meter key and each "A" position two service meter keys connected with relay controlled, electrically operated counters which are to be grouped together in a recess in the cable turning section.

The installation will include a chief operator's desk of the two-position type, which will include complete facilities for supervising the operating force, observing service on subscribers' lines and provide quick intercommunication with the wire chief and traffic chief. The equipment will include multiples of the line and supervisory pilot lamps in each position, service observation lines and trunk line equipment for the house circuits to the wire and traffic chiefs' desks. The monitors' taps to each position will be arranged so that the chief operator can listen to the operators without detection, or issue instructions to one or more operaors as required.

A wire chief's desk now in the possession of the company will be modified and re-equipped with all apparatus necessary to make accurate tests in connection with the exchange equipment to be installed.

The Stromberg-Carlson Company will furnish and install all new trunk line equipment made necessary at the telephone company's "Stone" and "Glenwood" exchanges by the installation of the new central office equipment at the "Park" exchange. It is planned to complete all work under this contract on or before September 10, 1917.

## Indianapolis Automatic Cut-over

In preparation for the cut-over from the old manually operated equipment to the automatic service which the Indianapolis Telephone Company began to furnish its subscribers on March 17, the officials sent a rush order to Automatic Electric Company of Chicago for 9,650 additional telephones and 3,450 lines of central office equipment, thus bringing up the ultimate capacity of the installation to 25,000 subscribers.

Work on the Indianapolis installation has broken old records for speed, and this without any sacrifice of quality. It was only July that the company made announcement of its plans to displace the manual switchboard with automatic equipment.

"So generous and whole-hearted has been the response of the Indianapolis public," said one of the officers of the company, "that we now have but one fear, namely, that the rush of new subscribers will find us unable to keep pace with the demand. To decrease that danger we have made this large new order for telephones and central office equipment, and the way things look now we will soon have to augment even this increased service.

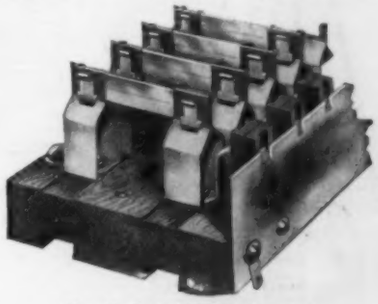
"The people appear to be thoroughly convinced that the new service will be by far the best that Indianapolis has ever enjoyed, and I am convinced that there will be a regular stampede of new subscribers."

William Fortune, president, and the other officials and directors of the Indianapolis company, are managing the business which was built up separately by the New Long Distance Telephone Company, the New Telephone Company, and the Indianapolis Telephone Company, all of which were merged last year, and incorporated for $8,000,000. It is not too much to say that the personnel of the company is recognized in Indianapolis as representative of the city's leading citizens and business men. The 4,600 miles of toll line cover 34 central Indiana counties and extend to exchanges in all the states near Indiana, including Michigan, Ohio, Kentucky and Illinois, with which the large share of the long distance traffic is directed from Indiana cities.

In addition to installing automatic service in the general exchanges, the Indianapolis company has found this an extremely opportune time to push the automatic private exchanges, of which eight have recently been ordered by large and important business organizations. So many other orders are almost ready to close for this service, that the company has ordered 15 private automatic exchanges for early delivery, and the prediction is made that by the time they can be unloaded in Indianapolis the whole number will have been sold.

## An Improved Switchboard Arrester

The improved No. 69 switchboard arrester, an illustration of which is shown herewith, is manufactured by the Stromberg-Carlson Telephone Manufacturing Company of Rochester, New York. It is intended for local battery exchange installations and furnishes adequate protection against abnormal currents and high potential dis-



*No. 69 Switchboard Arrester.*

charges due to lightning. The company states that the arrester is efficient, practical and sold at a price within the reach of every switchboard purchaser.

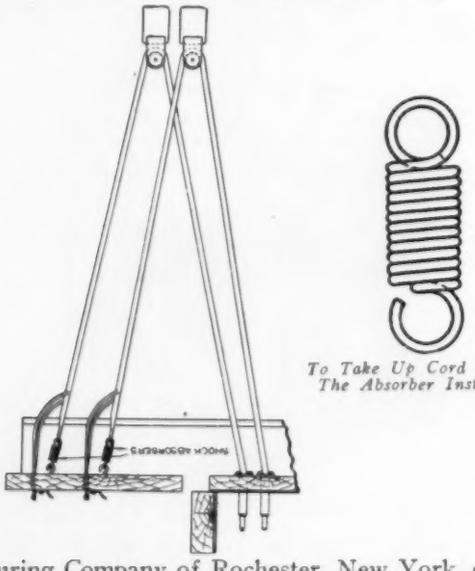
The No. 69 switchboard arrester comprises two elements, an arrester strip and a jumper strip. The arrester strip consists of a hard maple base, 11 inches long by 3¼ inches wide, having mounted thereon 10 pairs of carbon block arresters and fuse mountings arranged for copper terminal mica enclosed fuses. The units are spaced upon ½-inch centers. A ground strip runs the full length of the strip and is provided with a connector lug at either end. Screw terminals are provided on the jumper wire side and soldered terminals on the switchboard side. Holes are drilled in the base along side of the jumper terminals for "fanning-out" the wires. The jumper wire consists of a hard maple base, 11 inches long by 1⅜ inches wide with 10 pairs of connectors spaced upon ½-inch centers. The line cable side is arranged for soldered connections and the jumper wire side with screw terminals.

The arrester and jumper strip units are of convenient size for the growing exchange and are arranged for mounting upon a wall or on a vertical iron distributing frame section of 50, 100 or 150 line capacities, as desired. All equipment is secured to the mountings by machine screws extending through the wood with nuts in a recess on the back so that they can be tightened at any time without removing the strip from its fastenings. The fuse and carbon blocks are clamped firmly under a constant pressure to preclude the possibility of loose connections and imperfect contacts. Channel iron distributing frames for the No. 69 arresters are made in vertical sections 6 feet 6 inches high, and arranged for mounting either 50, 100 or 150 pairs of arresters and pumper strips. When a greater equipment is required, two or more vertical sections are installed side by side.

Any person interested in this arrester can obtain further details by dropping a line to the Advertising Department of the Stromberg-Carlson Company at Rochester, New York.

## Stromberg-Carlson Shock Absorbers

Not a shock absorber for automobiles, but a little device which the Stromberg-Carlson Telephone Manufacturing Company of Rochester, New York, claims will double the life of switchboard cords by taking up the "bang" when the operator releases the plug from the jack and the cord is carried back to its place by the cord weight. An actual size view of the shock absorber is shown herewith, also a view showing a section of a switchboard with the shock absorbers installed.



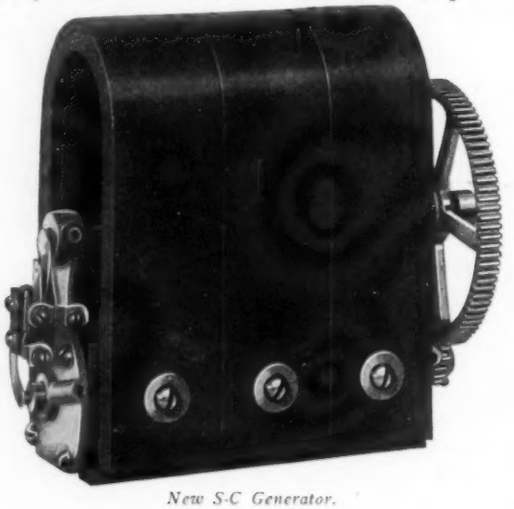
*To Take Up Cord Shocks. The Absorber Installed.*

The company states that the shock absorber can be easily attached and used with any make of cord. The Stromberg-Carlson Company has prepared a neat little folder which describes the shock absorber in detail. Any interested party can obtain a copy of this folder by applying to the advertising department at Rochester, N. Y.

## A New Switchboard Generator

Rural operating companies occasionally encounter ringing trouble on their lines due to overloading the circuit with subscribers' stations or to grounds and corroded splices. Under such conditions the operator is unable to ring parties at the distant ends of the line when using a switchboard hand-generator, which would give good service under the normal conditions for which it was designed.

The Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., has developed a new hand-generator for use in switchboards which terminate lines in which such unusual ringing conditions exist. Under tests made in the laboratory this new generator is claimed to have developed 38½ per cent greater output than any other switchboard hand-generator now made—the company's own five-bar generator included.



*New S-C Generator.*

In order to facilitate the use of this generator in all types of switchboards it has been made the same size as the standard five-bar Stromberg-Carlson generator and is interchangeable with it. The magnetic field is permanently maintained at a high flux density by three large magnets made of a special high quality alloy steel, the same as used in the manufacture of automobile ignition magnetos. The armature is wound to deliver a greater output at a higher voltage than standard five bar types when turned at the same speed and the voltage stands up better under heavy loads. The entire machine is built with the one dominant idea —greatest possible output.

The new generator, which has been coded as the Stromberg-Carlson No. 63 type generator, will not be furnished as standard equipment in switchboards manufactured by the Stromberg-Carlson company because the regular five bar types are adequate.

# Brevities of the Business

*The Activities of the Whole Telephone Field Told in Short Paragraphs*

## *PERSONAL NOTES*

Ferdinand W. Roebling, Sr., 75 years old, widely known in the wire rope industry, died at Trenton, N. J. He was secretary-treasurer of the John A. Roebling Sons Company.

J. B. Harper, who has been connected with the Cumberland Telephone and Telegraph Company's offices in Laurel, New Orleans, and Hattiesburg, Mississippi, for four years, has resigned his position with the local office to accept the position of chief bookkeeper of the Emerson Shoe Company at Chicago.

John H. Clune, 40 years old, district superintendent of the Central District Telephone Company at Butler, Pennsylvania, died in the Pittsburgh hospital. Mr. Clune was one of the best known telephone men in the state and recently was put in charge of the Butler division of the company. He was a member of the Knights of Columbus, Butler Lodge B. P. O. E., Western Pennsylvania Telephone Society, and the Holy Rosary Catholic church. He leaves his mother, three sisters and one brother, all of Homewood.

J. D. Russell, local manager for the Christian Todd Telephone Company at Russellville, Tenn., died from a stroke of apoplexy. He was about 50 years old and a prominent citizen. He had been with the Southern Bell Telephone system for thirty-five years and had been at Russellville for more than twenty years. He is survived by his wife and an adopted daughter.

Frank M. Kinney, late assistant manager of the Lancaster office of the Independent Telephone Company in Lancaster, Pennsylvania, has sailed for Honduras, Central America, where he will engage in the construction of telephone lines.

Nicholas Hughes, for forty years connected with telegraph and telephone companies of New York as a superintendent of construction, died of apoplexy in Mt. Kisco while looking over work for the New York Telephone Company. Mr. Hughes, who was fifty-seven, lived on One Hundred and Twenty-third street, New York City. Several grown children survive him.

The office of B. T. McBirney, general manager of the Cincinnati and Suburban Telephone Company, was banked with flowers when he occupied it for the first time in his new position. Callers thronged it all day and many were the congratulations showered on Mr. McBirney, who greeted each visitor with a genial smile and a hearty handshake.

C. M. King of Murphysboro, Illinois, has accepted the position of local manager for the Home Telephone Company to fill the vacancy made by the resignation of J. N. Ladd, who will leave for Murphysboro, where he has a position with the Murphysboro Telephone Company. Roy Scott has been placed in charge of the Mounds exchange. This place was vacated by G. S. Ladd who will also go to the Murphysboro company.

The appointment of E. C. Bradley of San Francisco to be assistant to the secretary of the interior was announced by Secretary Lane. Mr. Bradley formerly was vice president and general manager of the Pacific Telephone & Telegraph Company.

H. L. Warner, for five years in charge of the traffic department of the Southwestern Telephone and Telegraph Company in Houston, Texas, received a promotion and will be succeeded in Houston by G. K. Myers who has been district traffic chief for the company in Galveston. Mr. Warner goes to San Antonio to become district traffic supervisor, a field which offers him a larger opportunity.

Mr. D. A. Richey of the Cumberland Telephone Company, who has been located at Alexandria, Louisiana, for the past four years, has been promoted to be manager of the company's business at DeRidder, Louisiana.

D. A. Folger has assumed the local management of the Northwestern Telephone Company at Faribault, Minn., succeeding A. K. Woods, who has been given a leave of absence because of the death of his father, and that he may go to Sioux Falls to be with his mother until his father's estate is settled.

Thomas Jones, former district plan chief of the Hammond district, Chicago Telephone Company, has been promoted to the suburban plant department. F. E. Stewart succeeds him. Fellow employes gave him a diamond lodge ring and a banquet at the country club. District Manager O. A. Krinbill was master of ceremonies.

George Hale on April 1 takes over the management of the Buckley Telephone Company of Illinois, and his father, William Hale, who has been in charge of the work for so many years, will retire. Mr. Hale, Sr., expects to leave Buckley at a later date. The new manager has had much experience in all departments of the telephone business and we believe that he will make the company a good official.

C. D. Engstrand, formerly wire chief at the telephone plant at Missouri Valley, Iowa, has been transferred to Sioux City and his place has been taken by F. C. Anderson.

Frank Bossong, for many years in the employ of the Central Union Telephone Company and for two years with the Public Service Company of Illinois, has accepted the position as manager of the Reddick telephone exchange.

Enoch L. Murphy, thirty-eight years associated with the American Telephone and Telegraph Company and its subsidiaries, in managerial capacities, died at his home, 109 South Eighth avenue, Mount Vernon, New York, aged 59 years. Mr. Murphy was born in Ireland. In 1879 he joined the American Telephone and Telegraph Company, became its general superintendent of line construction, and in 1898 went with the New York Telephone Company as general foreman of the plant department. He formerly lived many years at Mattawan, N. J. He leaves a widow, three sons and two daughters.

Clay McClurg, who had charge of the Central Union Telephone Company interests at Mansfield, Ohio, for a number of years and was later with the company at Columbus, is engaged in the grocery business at Akron.

Paul Bone, son of Scott Bone of Seattle, Washington, has resigned as manager at Centralia of the Pacific Telephone and Telegraph Company. It is understood that he will be transferred to the Seattle office of the company. T. N. Riggen has charge of the office until Mr. Bone's successor is chosen.

The American Association of Engineers has appointed Paul P. Stewart, chief engineer and treasurer, Ketler-Elliott Erection Company, as a national director to succeed and fill the unexpired term of A. H. Krom, who resigned to become general manager of the association. Mr. Stewart is a well-known Chicago engineer, at present a member of the above mentioned firm. He is an '02 graduate of Yale and has been connected with U. S. Steel Corporation for many years, where he had charge of design and most of the construction work at Gary. He was formerly professor of structural engineering at Ohio Northern University.

## *NEWS FROM THE FIELD*

### ARKANSAS

W. C. Hays and the Bank of Amity have sold the Amity telephone exchange to W. H. Tweedle of Hollywood.

The Boone County Telephone Company has elected the following officers: Dr. J. L. Sims, president; W. J. Moore, vice president; R. H. Emery, secretary and manager; Will Coffman, treasurer. D. H. H. Fowler, Dr. T. P. Fowler, H. W. Redus, A. F. Moore and S. A. Lane, directors.

### DISTRICT OF COLUMBIA

Local telephone officials of Washington are awaiting orders to "mobilize" their share of a corps of 40,000 trained employes of the Bell system, who will form a military communication section in time of war. Women operators, according to plans of the telephone company announced recently, will form part of the signal corps.

### CALIFORNIA

The construction of a private telephone line from Dunlap to Lower Mill Creek is now in progress. It covers the Hopewell, White Deer and Lafever creek countries and is being constructed by private parties living along the line. It will end at Dick McHaley's ranch, on Lower Mill Creek. From there a short line goes to the Hazelton ranch, and from thence it will soon connect with Centerville. At the

Jones ranch, in White Deer valley, it connects with the government forest river line, which will place Dunlap in communication with most of the valley and mountain county.

The Pacific Telephone and Telegraph Company are about to start work on installing two copper wires between Sausalito and Petaluma and two wires between Sausalito and Mill Valley, the same costing $15,000. The improvement will benefit the service in San Rafael.

The last legal objection to the consolidation of the two telephone systems in Riverside has been removed in an order of the State Railroad Commission, granting the Pacific company the right to acquire the capital stock of the Home company. Under the order of the commission, the new system is to provide for the connection of all telephones under both systems here through one exchange, and subscribers are to have the privilege of keeping either the automatic or the manual instruments.

GEORGIA

The daily indication of Brunswick's phenomenal growth came in the form of an announcement from the Southern Bell Telephone and Telegraph Company, stating that Brunswick leads all other Georgia towns in telephone development and increases during 1917.

ILLINOIS

The Chicago Telephone Company has sold to William E. and Edward B. Quinlan, land 1 foot and 11 inches wide with a depth of 180 feet in Washington street, 140 feet west of Franklin street, for $7,187. This is at the rate of $312.48 an inch or about $3,750 a foot. The company subsequently leased back the strip for ninety-three years from November 25, 1916, at a yearly rental of $360 for the term. This is 4 per cent on $9,000. These deals resulted because of certain provisions regarding building foundations in a ninety-nine-year lease on 40x180 feet at 311 to 315 West Washington street, running from the Quinlans to William Bross Lloyd and others. In April, 1915, the telephone company bought from the latter the leasehold interest and building for $35,000, and from various other persons the 100 feet of frontage adjoining that holding on the west, with a view to improving the entire 140 feet with a ten-story operating building.

G. W. Cummings of the Chicago telephone bureau said he would save the city $72,000 on the survey to be made next year of the physical property of the Chicago Telephone Company for the purpose of revising rates. He said that outside experts would expend about $100,000 on the task, but that he had arranged to complete the work for a little more than $28,000. The survey he said would be much more elaborate than that made in 1912, which cost the city approximately $52,000. The revision of telephone rates made by Professor Edward W. Bemis in 1913 and 1914 cost the city $50,000.

The Forest City Telephone Company held its regular annual stockholders meeting at the town hall, March 6. There was probably the largest attendance that has been recorded by the company since its organization in 1902, there being 17 stockholders present in person, with a representation of 1081 shares out of a total of 1130 in force. In the directors' meeting that followed, E. L. Langston was re-elected president; O. S. Biggs of San Jose, vice-president to succeed P. S. Ingersoll, and Roscoe Smith, the present manager at San Jose, was elected secretary-treasurer.

The officers and patrons of telephone line No. 108 at Cuba had their annual meeting at the Blackaby school house. Officers for the ensuing year were elected, and included Ethan Blackaby, secretary-treasurer; W. D. Stell, president, and George Snively, director for three years. The assessments were levied to cover the expenses of the line for the coming year, and a very favorable report was made of the condition of the line.

The annual meeting of the Farmers' Independent Telephone Company of Canton was held in the company's rooms in the Home Telephone building and was well attended, representatives from all but one of the lines centering there being present. All the old officers were re-elected, as follows: President, Charles Lowe; vice-president, John Feeser; secretary-treasurer, Benjamin E. Neglay. Some of the lines contemplate more or less extensive improvements during the coming summer which will very materially help toward better service.

At a meeting of the stockholders of the Peoples Mutual Telephone Company held in Fellis theater at Hillsboro, David S. Grisham of Farmersville, E. N. Pray of Rosemond and Wm. E. Morain of Irving were elected as directors. Mr. Grisham takes the place of B. A. Stead, who stepped aside with the understanding that Mr. Grisham would accept the place on the board. The other two directors were re-elected.

A treat was given members of the Advertising association by the Chicago Telephone Company. They were served with lunch and then taken for a complete tour of inspection through the plant of the company.

Contractors are now at work remodeling the entire building known as the Felt building on South Main street, Galena, that has been leased by the Central Union Telephone Company, the same to be used by the local office of said company when completed.

The Hooppole Town Line Telephone Company held its annual meeting at the Hooppole town hall with a good attendance of the members. The annual report showed the company in first class condition financially and the lines in good condition or in such condition that they thought it advisable not to go ahead with future improvements until the price of material was considerably lower. The new officers are as follows: Directors, August Mathis, Otis Richards, J. A. Wiederhold, Frank Kiene and Warren Mathis; president, August Mathis; secretary, Otis Richards; treasurer, J. A. Wiederhold.

At the annual meeting of the directors of the Montgomery County Mutual Telephone Company, held in Hillsboro, the following three directors were elected for the ensuing term: Wm. E. Morain, E. N. Pray and David Grisham. The report of the secretary, Walter McLean, showed the company in the best condition financially and in every other way that it has been in since it was organized.

The Decatur Home Telephone Company has been sold to the Central Union Company for approximately $325,000.

Central Union Telephone Company linemen are completing the installation of the new cables which have been placed through Peru. Officials of the company said that the new cables made possible service from four hundred to five hundred more telephones.

The Hammond telephone district started the new year with a net gain of 332 stations for the month of January. Hammond's record last year was 1,519 stations. The new Chicago-Homewood telephone toll line, cut in February 14, is now in full operation with a rapidly growing patronage.

INDIANA

Judge Thornton of Room 1, Superior Court, approved a petition filed by receivers of the Central Union Telephone Company for permission to buy 1,498½ shares of stock in the Citizens' Telephone Company of Kokomo. The proposed purchase would give the Central Union Company control of the Kokomo concern, and the sanction of the Public Service Commission next will be asked.

The Telephone Society of Indiana, an organization of officers and employes of the Central Union Telephone Company, held its monthly dinner and business meeting at the Independent Turnverein. About forty members and guests were present. Guy Green, traffic superintendent of the Central Union Telephone Company at Indianapolis, read a paper entitled "General Operating Conditions," which was followed by a discussion.

Local stockholders of the Indianapolis Telephone Company were notified that the new automatic exchange at Indianapolis was cut-in on March 17. The company originally planned to spend $400,000 in rebuilding the plant, but so great has been the increase in business and so much business is in sight that $1,000,000 has been spent. The company has 17,000 telephones in Indianapolis, with every indication that there will be a great increase as soon as the new exchange is in operation.

The Eel River Telephone Company closed a deal whereby it comes into possession of the three-story building in which their plant is located and also two other buildings of equal size adjoining. The buildings are known as the Arnold buildings and were built originally for the Arnold bank that failed with a large loss a few years ago. No change in tenants will result from the change. The buildings were owned by Mrs. Laura Lower and are on Main street adjoining Eel river.

The Citizens' Telephone Company, of Brazil, has bought a site in the center of the business district for a new fire-proof telephone exchange building.

The Consolidated Telephone Company has bought the first and second floors of the Masonic building at Danville of Edgar W. Shirley, and has announced building operations that will require two years to complete. The entire plant of the company in Hendricks county is to be rebuilt. An automatic system will be used in Danville. The company serves Plainfield, Brownsburg, North Salem, Pittsboro and Fayette. The company recently was bought by the Indianapolis Telephone Company.

IOWA

Through W. J. McGowan of Cascade, the Prairie Springs Telephone Line became the owner of the Interstate Telephone

Company's line which runs from Lamotte to St. Donatus. The consideration was $475, and the new officers are Fred Wicke, president; John A. Felderman, secretary and treasurer.

The Hurmence Telephone Company has rebuilt the entire telephone system at New Hampton and its rural lines. The company has erected a splendid building on East Main street to house the local exchange. Approximately $50,000 has been expended by the company on this recent improvement.

A new telephone company to be known as the Northwestern Anti-Bell Telephone Company of Scott county has been organized among the farmers of the Stockton-Durant district and articles were filed for record in the county recorder's office by Attorney D. H. Snoke. According to the articles, the place of business will be at Durant, Iowa, but will operate between that town and Stockton in Scott county.

Telephone line sixty-two of Sciola held its annual election of officers, electing the following: President, George Devine; vice-president, C. F. Moates; secretary and treasurer, C. C. Anderson; representative, J. P. Mayhew; directors, Frank Gourley, George McNeal and H. A. Willwood; lineman, B. R. Mayhew. Other regular business was also transacted.

MICHIGAN

The Michigan State Telephone Company is making extensive improvements in the toll service between the twin cities, Eau Claire and Dowagiac. Two copper circuits are now in course of construction at an estimated cost of $12,000. Between the twin cities and Eau Claire 500 new poles are being set and about 15,000 pounds of copper wire is being used. Construction Foreman Kanode is in charge of the work and has a force of 40 men in his employ. It will require two months to complete the estimate. The iron circuit formerly used to Eau Claire will be left free to provide for an increase in the farm line business. There has been a marked increase in the toll business between the Cass county city and the twin cities and the improvement in the service became an immediate necessity.

At the annual meeting of the share-holders in the Southwest Moscow telephone line, the following officers were re-elected: President, W. J. Smith; secretary, Hulbert LaFever; treasurer, Ed. Houseknecht.

MINNESOTA

The Northwestern Telephone Company is receiving material and the work has begun of increasing the capacity of its telephone system. The board now has 1,470 telephones and 200 more are now being added. The size of the board will be increased further to take care of 300 more telephones, a total of 500 when the work is completed.

The Balkan Farmers' Co-operative Telephone Company met at Balkan social hall in Chisholm, drafted by-laws, signed an agreement with the Mesaba Telephone Company for central service and elected the following officers for one year: F. G. Harris, president; W. E. Bates, secretary-treasurer; Matt Boriin, Gust Lake and Paul Armistadl, directors.

Both the Northwestern and the Tri-State Telephone Companies will appeal to the district court of Steele county from the recent order of the state railroad and warehouse commission requiring the Northwestern Company to effect physical connection with the toll lines of the Tri-State Company at Owatonna. The Northwestern company contends the order would place it at a disadvantage to a competitor.

MISSISSIPPI

The conduits through which the wires of the Cumberland Telephone Company will run in the underground system have all been placed within the business portion of Meridian, and the work of running the wires through the ducts will soon begin. The system now ready for the placing of the wires is several miles in length, and it is possible that later on the underground system will be extended into some of the important residential sections.

MISSOURI

Three thousand Bell telephone subscribers at Kansas City, who had heretofore prefixed "South" before their numbers, became "Wabash" exchange patrons a short time ago. The new exchange to be known as "Wabash" was opened at Thirty-ninth street and Montgall avenue. The increase in the wire traffic in the southeast section of the city had become so heavy in the last year that the company found it necessary to add the new exchange.

Property at the southwest corner of Eleventh and Oak streets, fronting 126 feet on Eleventh and 100 feet on Oak street, Kansas City, has been acquired by the Southwestern Bell Telephone Company. Ground will be broken early in April for the erection of a modern, fire-proof main office building for the company. The building, which will be occupied exclusively by the Bell Company, will be of the most modern steel frame construction and fourteen stories in height. The foundation and construction, however, will be such as will carry six additional stories when the needs of the company demand greater space.

MONTANA

The Barb Wire Telephone Company was organized at Dunkirk. Thomas Cavitt was elected president, C. G. Hjalmson vice-president and Fred Cole, repair man. This company will install telephones at a very reasonable rate.

From 30 to 40 more employes will be added to the staff of the division offices of the Montana States Telephone and Telegraph Company, when the auditing department of that company in Butte is moved to Helena. They will occupy space on the third floor of the local office in the Gold block, where the company moved just before the end of last year from their old quarters in the Pittsburgh block. Arrangements are now being made to accommodate the new office in Helena.

The much talked of extension of the Darby-Wisdom Telephone Company from Darby to Wisdom will be started in the near future and is to be finished by the end of the summer, say officials of the company. Two years ago the company bought the Darby exchange from the Mountain States Telephone people. At that time there was considerable discussion of the extension. Local residents are elated with the news, as the extension will greatly facilitate wire communication with Missoula, Butte and other large centers.

NEVADA

The Bell Telephone Company has applied to the county commissioners for the privilege of extending the toll line from Wadsworth to Fallon. The company offers to rebuild the present line, which is badly in need of repairs, and give the county twenty-five per cent of the tolls. It will probably cost $10,000 to rebuild the line.

NEW YORK

Mary D. Fitzsimmons has sold to the New York Telephone Company the building at 224 West Thirty-sixth street, New York City, on lot 20x98.9. The property was bought by Michael Fitzsimmons, deceased, in January, 1871, for $13,000. The telephone company owns 206 to 222 and together with the above has a plot 182x98.9, which is to be used as a site for an exchange building. Jacob J. Tabolt negotiated the deal.

NORTH DAKOTA

The Gaylord Telephone Company of Gaylord, which plans to build a line from Belfield south through the western part of Stark county and the southeastern part of Slope county has incorporated for $10,000. The officers are: V. A. Smith, president; Joseph Schwartz, vice-president; Shelby Ward, treasurer; A. B. Cooke, secretary, and Otto Uggla, director.

A new telephone company, under the name of the New Hradec Telephone Company, has been organized, the members including fifteen farmers residing north and northwest of Dickinson. A meeting was held for the temporary organization of the company and it is expected that it will be made permanent at the next meeting. The officers chosen are as follows: Vincent Kovash, president; A. G. Sadowsky, vice-president; John Fisher, secretary; Louis Kostelecky, treasurer.

At a meeting of the Flasher Rural Telephone Company held at the Bollinger school house near Flasher, Howard Lindbloom was elected director of the concern for a term of three years.

OHIO

All directors of the Ohio State Telephone Company were re-elected at the stockholders' annual meeting, save F. F. Prentiss of Cleveland, who was unable longer to give his time to the work of the company. His place was filled by the election of Frank L. Griffith of Columbus. The annual report showed there had been transferred to surplus from the earnings of last year $188,025.12. The total revenue of the company for the past year was $3,689,606.91 and expenses $2,216,101.48, leaving an income from operation of $1,473,505.43. The balance sheet showed the total assets of the company were $27,703,124.37.

The Blue Creek exchange of the Adams County Telephone Company has been moved from Blue Creek to Wamsley. The Mineral Springs exchange will be abandoned also and its subscribers placed on the Wamsley board.

The annual meeting of the stockholders of the Crooksville Telephone Company was held in Zanesville. Directors were chosen as follows: T. F. Wilson, William Harris, Paul Southard, S. R. Souders, J. L. Bennett, H. E. Southard and J. B. Rhoades. The directors organized by the election of the following: President, T. F. Wilson; vice-president, William Wilson; secretary and general manager, J. B. Rhodes; treasurer, J. L. Bennett. The company now has 342 subscribers.

Central Union Telephone Company will take over the business of the Cambridge Home Telephone Company.

Concrete construction work on a new central exchange building at Lorain, being erected on a Ninth street site for the Black

River Telephone Company, was begun a short time ago. The building probably will be finished during the coming summer. With the completion of the exchange building, a new all-automatic telephone system is to be installed.

L. V. Beamer, of the local branch of the Central Union Telephone Company at Massillon, said that extensive improvements, costing $30,000, are now being made in the local plant to take care of rapidly increasing business.

The annual meeting of the stockholders of the Millersburg, Wooster and Orrville Telephone Company was held in Millersburg. No changes were made in the directors or officers for the coming year. The following were re-elected directors: C. M. Lovett, Frank L. Beam, M. M. Herron, H. W. Cary, Otto Troutman, T. E. Steiner, D. F. Griffith, A. N. Brenneman, H. M. Rudy. C. M. Lovett, of Wooster, was re-elected president; Frank L. Beam, Mt. Vernon, vice-president; M. M. Herron, Millersburg, secretary and general manager, and H. W. Cary, Millersburg, treasurer.

According to a reliable report negotiations have just been completed whereby the telephone company at Girard leases the rooms above the Trumbull Savings and Loan as new quarters and plan to take possession in the near future installing a great deal of new and additional equipment of most modern type.

Permission to open Richmond street from Grand avenue to Santa Clara street for the purpose of installing an underground cable, was asked by the Central Union Telephone Company at Dayton. The proposed construction is a part of the work preliminary to the erection of an exchange near Richmond street and Delaware avenue. The growth of the city in the north and northwest sections has made added facilities necessary.

Representatives of nearly 300 small Independent telephone companies in Ohio formed the Ohio Co-operative Association of Telephone Companies, the announced purpose of which is to take a more active part in political affairs of the state and particularly with reference to legislation affecting their interests. The members declared they were being discriminated against in favor of the large telephone interests of the state. J. T. Christy of Monroe county was elected president, and C. E. Hermetet of Sidney, secretary and treasurer.

The Cleveland Telephone Company took title to a parcel 55 by 100 feet on Guthrie avenue S. W., for a $2,500 consideration. According to Allard Smith, general manager of the Cleveland Telephone Company, erection of an entirely new building to replace the present Edgewater exchange at West Sixty-fifth street and Guthrie avenue, is contemplated. The new exchange will be erected on an L-shaped parcel that will have a depth of about 200 feet.

SOUTH DAKOTA.

J. L. W. Zietlow, president of the Dakota Central Telephone Company, announces the company will expend $200,000 for an entirely new exchange in Aberdeen when the new building is ready for occupancy.

Since December 1, 1916, the first vocational school to be established in Sioux Falls by a firm or corporation has been in progress with an enrollment of 28 pupils and yet there are probably less than a hundred people who know of the fact. With the idea of securing more efficient service the American Telephone & Telegraph Company of which the local Northwestern Telephone Exchange is a branch, established a school in elementary telephony for the benefit of the male employes at the local plant. This course is optional with the men and is given to them free of charge providing they purchase their own lesson sheets which cost 25 cents for a course of 13 lessons.

Plans are being made to connect Newell and Castle Rock with a telephone line as soon as spring opens up. This line will connect with the Belle Fourche & Northern Telephone Company at Newell and extend to Castle Rock, taking in the farmers on the way and in the vicinity of Castle Rock.

Articles of incorporation have been granted for the Farmers' Mutual Telephone Company, of Morristown with a capital of $2,000. Incorporators, William Hardke, J. G. Rapp, A. W. Voos.

TENNESSEE.

The farmers on the Newbern and Yorkville road are installing telephones into their homes and will connect with the Cumberland Company here. The farmers in every district of this section have erected their own lines, the systems being known as the Farmers' Home Telephone Company.

TEXAS.

E. M. Rogers, the new commercial manager for the Amarillo District of the Southwestern Telephone and Telegraph Company, has returned from a trip over various sections of the Panhandle. He came to Amarillo from Sherman and expressed himself as being highly pleased with the active business spirit found here.

Dallas telephone development is the highest in the world, Nathaniel T. Guernsey, general counsel for the American Telephone and Telegraph Company and associated systems, with headquarters in New York City, told the members of the Bar Association of Dallas and guests at a luncheon at the Oriental hotel. "Considering both systems, Dallas has twenty-eight and a fraction telephones for every 100 people, or one telephone for every three and a fraction people," Mr. Guernsey said. "There are in use in Dallas 28,000 Bell telephones and 7,100 automatic telephones, or a total of 35,100 instruments.

The Southwestern Telegraph & Telephone Company has made an important reduction in night long distance calls. The reduction, which is known as a "social rate," will be made between the hours of 8:30 p. m. and 6 a. m. each night and will amount to a saving of a third of the cost of the present night rate up to a cost of $1 and forty per cent of the regular night rates on calls costing more than $1.

With several members of a signal corps, each carrying a mile of telephone wire on his back of such fine texture that the rolls do not weigh more than a few pounds each, a new method of field communication was successfully tested at Leon Springs. By attaching the units carried by the soldiers a communicating system several miles long can be established where access to the reel wagons now in use would be impossible. The roll of wire is so arranged on the soldier's back that it offers no inconvenience and rough country can be negotiated with ease.

The San Antonio Telephone Company was sold on a judgment of foreclosure of lien to Ross Larrabee of Kansas City for $74,000.

Burt C. Blanton, formerly of Houston, now an engineer of New York City, has invented and patented an "air-wave" telephone, to be used on steam and electric railways. This device, it is said, will enable persons on any portion of a train to communicate with persons on any other part. It is attached to the airbrake tube, the delicate mechanism of the telephone registering the sounds carried on current-waves of the compressed air. It is claimed that the human voice can be clearly understood over the new telephone.

WASHINGTON.

Exchanges in Pasco, Oroville and Riverside, and 570 new telephones in Spokane have been put in in 1916 by the Home Telephone Company. The company reports the expenditure of $510,000 for betterments and repairs in the Spokane district this year.

WISCONSIN.

The Wisconsin Telephone Company is building extensions on its rural lines west and northeast of the city which, when completed, will give service to twenty additional subscribers, and relieve circuits that are now congested. It will require two months to finish the job, representing an outlay of $3,500.

Cascade Telephone Company installed a new telephone line last week from Winooski to Plymouth so the subscribers of Winooski may call Plymouth direct.

Plans and specification are being made for the new building of the Wisconsin Telephone Company in Racine. It will be erected at Park avenue and Seventh street. Excavations for the foundation walls will be commenced as soon as possible after the frost is out of the ground. The structure will be one of the largest and most modern, for telephone purposes, in the state and probably will cost, fully equipped with switchboards, etc., $150,000. It is the intention of the company to make the improvement possible to take care of the business until Racine reaches a population of 150,000 to 200,000.

Connection may soon be established between the Wisconsin and Ashland Home Telephone Companies.. Managers of both concerns assured the Ashland Commercial Club that they were willing to recommend such a move.

The Knapp Telephone Company held its annual meeting on January 15. The report of the secretary showed a healthful increase during the past year. Considerable new line was constructed during 1916 and twenty-five new telephones added. One of the first things to be done in the spring will be to run another wire north about four miles and split line three, which is overloaded. During the last two years all lines constructed with native poles have been rebuilt and with the exception of a few spurs going into farm houses the entire line is now cedar.

WYOMING.

Sparks' Telephone Company was incorporated in the office of the Secretary of State, Cheyenne, Wyoming, at 10 o'clock a. m. on the 21st day of December, 1916. The object of the company is the maintenance and operation of a telephone and telegraph system. The capital stock is ten thousand dollars ($10,000) divided into one hundred (100) shares of the par value of one hundred dollars ($100) each. Term of existence is fifty (50) years. The operations of the company will be carried on in Rock Springs, Sweetwater county, Wyoming.